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About Authors

● *Many days of constant personal contact with leading automotive engineering executives and designers in Detroit, reams of correspondence, and weeks of careful study and analysis of passenger-car specifications, have been the immediate background of* T. A. Bissell's *(M '37) paper "Trends in 1940 Passenger Cars." Mr. Bissell, who has been technical editor of the SAE Journal since 1935, received his M.E. from Cornell in 1923. He had eight years of plant, production, and sales engineering experience before he began his editorial career on the staff of "Maintenance Engineering," a McGraw-Hill publication. Since then he has been doing technical editorial work.*

● *It was back in 1909, when Sears, Roebuck & Co., put him to work as a tester of motor buggies, that* A. S. Krotz *(M '26) took a serious interest in the automotive industry. Adding to his education while a garage mechanic and a production worker at Packard, he advanced to plant superintendent of a small war truck plant, worked for General Motors research, and was assistant general service manager for Stutz and Marmon. He joined General Motors Export, went to Germany as production manager of General Motors G.m.b.H., Berlin, was at General Motors Proving Ground for two years, and spent a couple of years in Chevrolet's engineering department. In 1936, B. F. Goodrich Co. engaged him to continue the development of rubber suspension, and he is with that company today as development engineer, working on various rubber problems, particularly on the application of rubber torsion springs to the suspension of motor vehicles, and on the springing of street and railroad cars.*

● *When the SAE World Automotive Engineering Congress was over,* Robert J. Nebesar, *who wrote "Transatlantic Airplane Design" while chief engineer of Avia Aircraft Corp., Prague, Czechoslovakia, remained in America to take the post of chief engineer with Howard Aircraft Corp., Chicago. A graduate mechanical engineer of the Technical University*

(Concluded on page 19)

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Science Holds Living Standards Up, Dr. Compton Says at 1939 Annual Dinner

Dr. R. E. Wilson, toastmaster, and Dr. Karl T. Compton, speaker at 1939 SAE Annual Dinner

SCIENCE and democracy flourish together, Dr. Karl T. Compton, president, Massachusetts Institute of Technology, proclaimed to more than 1000 SAE members and guests at the 1939 Annual Dinner on Oct. 16 at the Hotel Pennsylvania in New York. "Really new and epoch-making discoveries do not spring from regimentation," he said, "they spring from individual genius in an environment favorable to the man who is different – to the pioneer."

Science can be used to remove some of the current causes of war, Dr. Compton showed, because discovery and development of the good things of life by science, engineering, and invention are a far more certain and productive source than organized loot and robbery. He voiced the belief that "a great part of the necessities of national economies could be taken care of by scientific research, at a cost far less than that of a major war and within a time far less than that in which the effects of a major war could be recovered from." To the extent that science can produce needed materials or suitable substitutes, he pointed out, it will be removing the only basis for war which can be intelligently argued at the present time. In so far as wars are caused by the natural "cussedness" of human nature, however, he admitted that science could contribute little or nothing to their elimination.

The opportunities for social planners in the United States to devise schemes of education, social security and community betterment, he emphasized, "have been brought about almost entirely by the increased productive power which has resulted in every person in the U. S. having working for him, on the average, a machine power equivalent to the labor of more than 50 slaves.

"One of our greatest dangers," he warned, "is losing the benefits of science through policies which may be embarked upon with the most altruistic of intentions but with a fatal lack of understanding of some fundamental considerations." Should current programs of social security be pushed beyond the limits which the present state of technology can support, the whole structure of social security and high standards of living may fall like a house of cards, Dr. Compton predicted.

"No laws or political slogans or labor union rules or industrial codes," he postulated, "can in themselves support a high standard of living on a program of social security. These can be supported only on production of things which people need and are willing to work and pay for."

Democracy, Dr. Compton concluded, gives the most favorable frame work ever devised within which to receive and enjoy the understanding of nature and the technical skill to create health, wealth and happiness which we acquire through pure and applied science. "The herd instinct," he said, "leads to safety, group efficiency and stagnation. The individualistic instinct leads to risk, discovery and progress. The former is regimented and conservative, while the latter is disorganized and progressive. In the former, the individual exists to serve the state, in the latter the state exists to serve the individual."

Dr. Compton's address climaxed the dinner at which Dr. Robert E. Wilson, president, Pan American Petroleum & Transport Co., was toastmaster.

SAE President W. J. Davidson, Diesel Division, General Motors Corp., after conducting a brief business session, introduced Arthur Nutt, vice-president, Wright Aeronautical Corp., who is the SAE presidential nominee for 1940. Pledging his best efforts to the furtherance of every phase of SAE Activity, Mr. Nutt expressed his deep appreciation of the honor which had come to him.

Borrah Minevitch's Original Harmonica Rascals was the entertainment feature of this most successful 1939 Annual Dinner Program.

"Trends in Design of 1940 Cars"

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News of the Society

John S. Erskine, SAE Vice-President representing Tractor & Industrial Power Equipment Activity

Sharp Debates Mark Sessions at National Tractor Meeting

DEBATES about how best to protect tractor engines against dirt and wear, exploration of current lubricating and cooling problems, and discussion of a newly proposed SAE air cleaner test code were highlights of the SAE National Tractor Meeting held at the Hotel Schroeder, Milwaukee, on Sept. 28 and 29. Billed as a "Seven All-Star Event," the two-day program brought sharp differences of opinion on almost every topic paraded. The value of compounded oils was questioned and defended, argument arose as to whether oil will adhere better to smooth or rough surfaces and fuel technicians clashed with oil filter men about which group is responsible for oil breaking down as rapidly as it sometimes does. Sparks of new knowledge were scattered from every discussion to the 425 tractor engineers, allied technicians and guests who attended.

Wallace Talks at Dinner

Four technical sessions, a visit to the A. O. Smith Corp. factory and a dinner addressed by David A. Wallace, president, Chrysler Sales Division, Chrysler Corp., made up the program. J. B. Fisher, Waukesha Motor Co., was chairman of the Oil Filter Session on the opening morning. T. L. Swansen, Allis-Chalmers Mfg. Co., had charge of arrangements for the plant inspection tour, SAE Vice-President John S. Erskine, International Harvester Co., presided at the dinner with V. R. Jacobs, Goodyear Tire & Rubber Co., as toastmaster. On the second day, Elmer McCormick, John Deere Tractor Co., presided at the session in the morning and C. E. Frudden, Allis-Chalmers Mfg. Co., at the afternoon session.

Discussing the effect of oil filters on the lubrication and wear of tractor engines, James E. Hurn, DeLuxe Products Corp., pointed out in the opening paper of the meeting that filters are not a cure-all for engine wear. High quality oil must be used, he emphasized, to cut down wear in any engine. He said that "savings are dependent upon the proper capacity of filters and the proper application of the filter together with the use of good oil."

The duty of modern oil filters is to maintain the oil as a satisfactory lubricant through removal of sludge, corrosive compounds and asphaltenes, materials directly responsible for engine wear. Failure of a filter to remove and eliminate deposits in a motor is usually the result of improper application of a filter or an inadequate filter capacity. Excessive cylinder wear, ring wear and even bearing failure may be traced back to incorrect lubrication of the engine, he said. Tests have proved conclusively, he stressed, that proper application and capacity of filter removed the asphaltic materials from the oil so that lacquers could not accumulate in the engine, eliminating the usual failures.

Costs connected with installation or maintenance of filtering equipment, while a predominant factor in operating costs of an engine, are usually reduced through the savings which result from reduction of motor maintenance through a minimum of wear, and through oil savings.

Mr. Hurn recommended the use of absorbent-type filters pointing to tests which have proved that apparently clean oil can contain contaminants which deposit as gums and lacquers, and that an absorbent filter readily removed these contaminants before they had a chance to deposit and contribute to engine wear.

"In supplying the correct capacity filter for an engine, it is absolutely necessary to know the characteristics of the engine," Mr. Hurn said in concluding his paper. "Fuel contamination from the combustion chamber, as well as the characteristics of the engine, as it relates to oil breakdown in the crankcase, must be correlated, and on this correlation will depend the flow specifications and capacity of the filter. Very often, when this has been determined, it has aided the engine manufacturer in improving the engine design to produce a motor which gave better operating efficiency from both the oil and fuel standpoint."

Oil Filters Discussed

The natural enemy to the tractor engine is the abrasive material which is drawn into it either through the carburetors, the breathers, or other openings in the crankcase not properly sealed, L. W. Williams, Motor Improvements, Inc., contended in his paper, "The Oil Filter's Contribution to the Tractor Industry." Adoption of air cleaners, improved seals of the crankcase, internal breathers, and other means of keeping abrasive material out helped to lengthen the time between overhaul periods, but it was not until the introduction of oil filters that definite steps forward were noted in keeping oil free from impurities, with a resulting material increase in the life of engine parts and a prolonged period between overhauling and replacement of these parts.

Frequent change of the filtering medium was first overcome by the introduction of metal edge type filters, Mr. Williams said in discussing the progress made in oil filters during recent years. Present-day filters have the ability to absorb large quantities of solids to keep the oil in the engine in most cases in a bright condition to the eye, he pointed out. Credit for keeping oil in good condition, and thereby reducing engine wear, was also given to tractor manufacturers, who, it was pointed out, are properly cleaning the engines after assembly and are removing built-in dirt, core sand and gray iron, dust and metal chips. Methods of finishing surfaces of the crankshaft and cylinder liners have been greatly improved also, so that the operator today, with the aid of the newest type of lubricating oil filters, is insured against anything but a minimum of engine wear, necessitating only infrequent overhauls and allowing for minor adjustments in place of major overhauls.

"On the whole as we look back over the improvements the tractor industry has made in the last 20 years, we cannot help but feel that the oil filter has played a major role in making it possible to build a finer piece of mechanism to put in the hands of the operator in the field, and at a cost not only less to buy new but to keep in first class running condition over a long period of time," the paper pointed out.

Results of years of designing, building, and testing lubricating systems for internal combustion engines, was the theme of "Modern Methods of Conditioning Lubricating Oil During Use," a paper by Charles A. Winslow, read by J. T. Greenlee, Winslow Engineering Co. Facts and records of results of tests were illustrated by slides shown during the reading of the paper which dealt briefly with the design of the various types of filters, told of results of actual tests, both field and laboratory, and described what actually happens to engines, filters, and lubricating oil during normal service.

Compounded Oils Argued

Differences of opinion were evidenced regarding the value of compounded oils in discussion from the floor at the conclusion of the three papers. It was the contention of F. L. Miller, Standard Oil Development Co., that the use of additions to oils would become more general in the future, because tests show that engine wear

(Continued on page 22)

Aircraft Men at L. A. Stress Technical Aid to War Needs

By Charles F. McReynolds

AIRCRAFT production is the key to victory in future wars!

Maintenance of military aircraft, say the experts, is a silly thing to think about. In wartime aircraft will be expendable, like ammunition. We won't have time to repair worn and damaged military planes. And all we can do about the planes lost in action is to replace them with new ones. So production is the problem. Production of military planes is held to be the key to supremacy in the air. The country that can build the fastest, other things being equal, will win out. The country that can swing into a major wartime production program, from normal peacetime pursuits, will have a tremendous bulge on the battlefield.

If the above is true then the 1939 SAE National Aircraft Production Meeting, held in Los Angeles, Oct. 5 to 7, was a powerful factor in perfecting America's military defense program. Attended by thousands of engineers, who heard a comprehensive schedule of production papers presented, the meeting forged a powerful link in our aerial chain of defense. With the quick subjugation of Poland in the minds of everyone, and the unspoken question, "Where will the aerial lightning strike next?" agitating many, the Los Angeles sessions drew the attention that springs from thinking tuned to war problems.

Voicing this military thought in his introduction of Brig.-Gen. Jacob E. Fickel on Friday evening, Robert E. Gross, president of the Lockheed Aircraft Corp., said, "The airplane has thrilled the hearts of millions, but it has numbed and paralyzed with fear and devastation, peoples, and cities and nations. It has made our nation a neighborhood but it has made the world a battlefield. History is being written, not in the chancelleries of nations, but on the drawing boards of aviation's engineers." On the same day Adolf Hitler, before the Reichstag, was telling the world that "There are no longer any islands in the world." So the shadow of the bombing plane fell heavily across the Los Angeles deliberations.

In the climaxing address of the meeting, Gen. Fickel, outlined rapid progress that has been made on the president's air expansion program. Speaking in place of Louis Johnson, assistant secretary of War, who was forced by the present emergency to remain in Washington, Gen. Fickel said that military production was being stepped up faster than had been believed possible in this country on such short notice and that, "We know with the increased facilities and larger appropriations for research and experimentation now available, that this country will remain in the lead in advanced design, and will meet any challenge for supremacy in the air."

Attendance Records Shattered

Attendance at all sessions of the three-day meeting was conservatively estimated at approximately 3000. Actual registrations totaled 875 and it was believed that at least that many more people visited the meeting. Nightcap gathering was the Saturday evening dinner dance at which the Southern California Section of the SAE acted as host. The session was devoted entirely to social activities except for a brief speech of welcome by E. W. Templin, chairman of the Southern California Section. The distinguished group of aviation people present included most of the big names in Southern California aircraft production circles. Ever present and active throughout the series of meetings was Mac Short, general chairman and president of the Vega Airplane Co., ably assisted by Mrs. Short. J. H. Kindelberger, president of North American Aviation, Inc., served as chairman of the aircraft engineering display committee. This aircraft engineering display, an innovation at SAE production meetings, proved a complete success. Exhibits crowded all available space and won the attention of all in attendance at the meetings. And the parts and accessories shown matched the papers read for timeliness and quality.

Production of aircraft, engines, propellers and aircraft accessories was covered during the meeting, with consideration given to various current design problems in connection with development and production of aircraft, and with thorough treatment of the two metals most important to aircraft production, aluminum and magnesium. Great emphasis was placed on the importance of developing prototype aircraft rapidly, so that they will not be obsolescent before placed in production; and with an eye to shop problems so that the design can go into production without further delays after it has passed performance tests. A look into the future was given by two papers devoted to problems of submerged engine installations, with powerplants completely enclosed within the wings and propellers driven through extension shafts. The meeting was rounded out by a full report on progress of the CFR Vapor Lock Project as related to vapor lock in aircraft fuel systems.

Thursday morning, October 5

Mac Short, *general chairman*
A. L. Klein, *session chairman*

Welcoming visitors and all in attendance at the 1939 SAE National Aircraft Production Meeting, Mac Short, general chairman, briefly referred to the rapid production increases which have been experienced by the aircraft industry, and to present need of efficient production methods for military reasons. This session brought detailed production information to those in attendance, and information of wide application to all aircraft machine work.

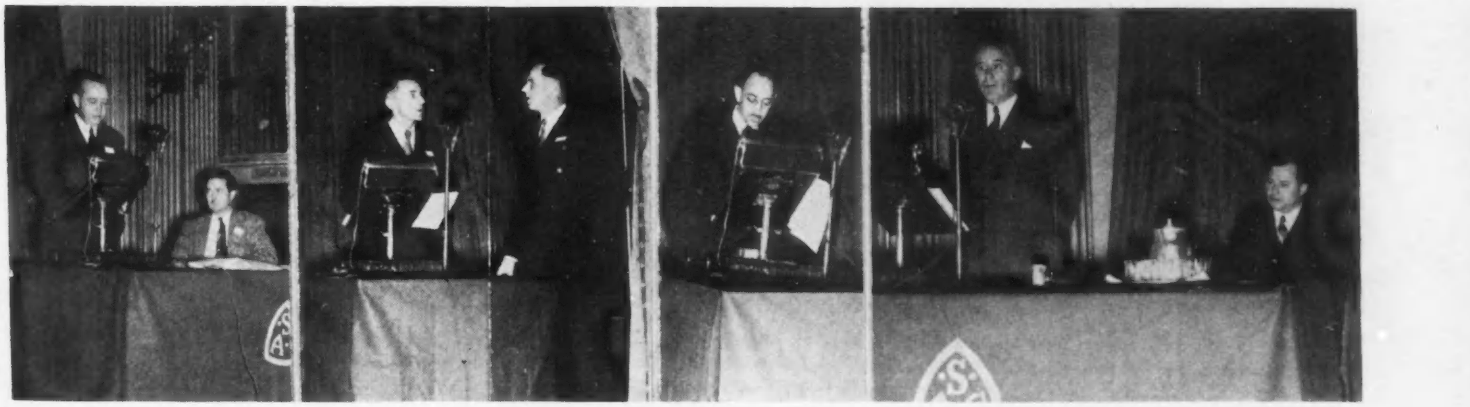
Propeller Production – ***Arvid Nelson, Hamilton Standard Propellers.***

Following, in a broad manner, the general history of airplane propeller manufacture, this paper dealt with modern machine production methods of manufacturing all-metal hydromatic propellers of constant-speed type, as compared with early production methods of making wood propellers by hand. Major operations were illustrated with slides, and an excellent moving picture of modern machine methods in the Hamilton Standard plant was shown at the close. Many machine operations were shown and described in great detail.

Airplane Brake Installation and Control Considerations – ***Henry H. Kerr and F. C. Frank, Bendix Products Div., Bendix Aviation Corp.*** **(Presented by Mr. Kerr)**

A brake and wheel combination of proven capacity will deliver its best performance only when the conditions under which it must operate are favorable, i.e., approximate those for which the unit was designed. This paper discussed these conditions and suggested methods for their control to the end that more effective brake per-

Some Speakers and Chairmen at Aircraft Production Meeting Sessions



(Left to right): L. B. Grant, Dow Chemical Co., and Brint Edwards, Douglas Aircraft Co., Inc., who spoke and presided at the Saturday morning session; Courtney Hertel, Douglas Aircraft Co., Inc., speaker, and Carleton E. Stryker, Bendix Aviation, Ltd., chairman, at the Thursday afternoon session; Henry H. Kerr, Bendix Products Division, Bendix Aviation Corp., co-author of paper presented at the opening session; Brig.-Gen. Jacob E. Fickel, United States Air Corps, who addressed the Friday evening session, and Robert E. Gross, Lockheed Aircraft Co., who introduced him.

(NAPM Photographs by C. F. McReynolds)

formance might be obtained. Three vital factors were outlined as: (1) the brake must be of adequate size; (2) the installation of brake and wheel on the landing gear must induce efficient brake operation; (3) the brake operating device must be suitable; must transmit the pilot's desire to the brake with least error so that he may accurately anticipate reaction.

Discussion

A question concerning drum irregularities brought the comment from Mr. Kerr that drum cooling is of considerable importance. Unequal heating or insufficient cooling of the brake drum is likely to cause warping and even cracking or checking of the drum surface. Asked what portion of the maximum coefficient of friction of a given tire might be used without upsetting the plane, Mr. Kerr replied that this was entirely dependent upon the plane's design, location of the landing gear, and conditions of braking. Tires could be slid on the runway under wet-weather conditions, or during the first part of landing run when much of the plane's weight is still borne by the wings, but generally the design is such as to limit braking effect to less than the maximum coefficient of friction of the tires used. Dr. A. L. Klein thought heavy loads were imposed on wheels by deflection of landing gear axle stubs. But Mr. Kerr reported no tests verifying this, and thought airplane wheels were peculiarly adaptable to application of such stresses. He knew of no wheel-bearing failures that had occurred due to flexing of axle shafts. C. E. Stryker, Bendix Aviation, reported that tests had shown a maximum deflection on the Douglas DC5 axle stub of but 1½ deg including deflection of the oleo strut.

Design and Shop Problems in High-Pressure Hydraulic Systems – *Harold W. Adams, Douglas Aircraft Co., Inc.*

The chief reason for using higher pressures in hydraulic control systems is the resultant weight saving, this paper brought out. The design problem is simply one of more careful and thorough design, except for the pumps, which present a separate problem. High pressure systems, when properly designed, present no serious shop problems, from a production standpoint, in fact have some advantages. Finer, more accurate finishes are required, and closer tolerances must be held everywhere, but this is made easier by the heavier wall thicknesses so that actual production costs balance for both systems. Maintenance and operating problems are no different, for the most part, with either system. High pressure systems are defined as those in which pressures in excess of 2000 lb per sq in. are used; compared to the standard system pressure of 1000 lb per sq in. or less. Danger in event of failure in the system was thought about equal for both high and low pressures.

Discussion

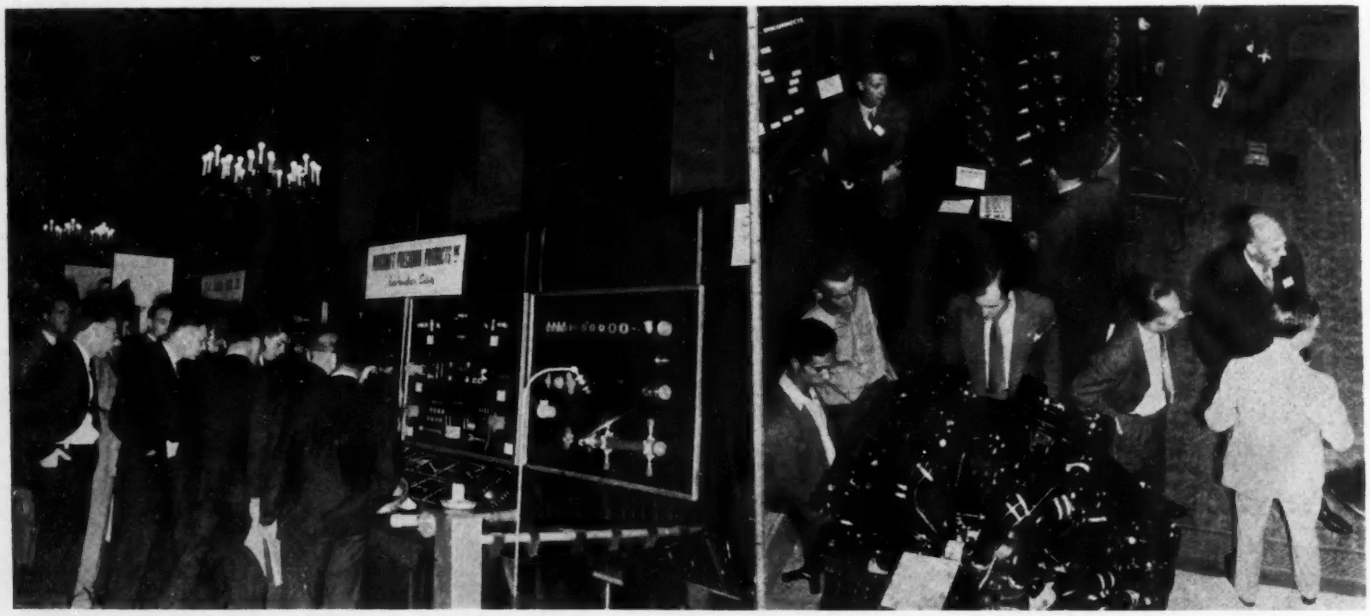
A prepared discussion by J. W. White, chief engineer, Brake and Hydraulic Division, Bendix Products, which was read by the chairman, pointed to the real problem in application of high pressure systems as being a suitable pump. Vane pumps are only suitable for low pressure work, Mr. White said. Gear pumps are not satisfactory for pressures above 1500 lb. For the high pressures under consideration some form of piston pump is needed. This should be a variable displacement pump with automatic regulation for constant pressure. White agreed with the author that expansion of cylinders under high pressure is a real problem.

C. Howard Eden, the Eden Machinery Co., asked what planes have been equipped with such high pressure systems as described by the author. To this Mr. Adams replied that only the giant Douglas DC-4 had been so equipped. C. E. Stryker asked about the desirability of using a profilometer for super finish of hydraulic system parts. Mr. Adams thought this subject a controversial one. Mr. Eden reported that the profilometer, if properly uesd, would allow finishes no more expensive to produce than standard finishes. He then asked what maximum and minimum temperatures could be experienced and still permit functioning of such a hydraulic system. The author reported temperatures of —20 F on the ground, and —70 F in flight as a minimum, and approximately 160 F as a maximum. Barney J. Vierling, engineer, Pennsylvania-Central Airlines, wanted to know what advantages other than weight saving were claimed for the high pressure system. No other advantages were considered, said Mr. Adams, but on the DC-4 the weight saved had been approximately 600 lb. Also, installation and servicing of the high pressure system was simpler and cheaper because all the parts are smaller. These advantages are greater for larger planes, but with suitable development work such systems might be applied to planes such as the DC-3, or even smaller aircraft. T. P. Wright, Curtiss-Wright Corp., asked what the relative weight saving was for large vs. small aircraft, and for various parts of the standard vs. high pressure hydraulic systems. To this Mr. Adams suggested, as a guess without reference to data, that on a plane such as the DC-3 a little less than half the weight of the system could be saved, and on the DC-4 a little more than half. He reported that the weight saving on lines is about half in going from 800 to 3000 lb working pressure. Cylinder weight is also reduced about half, but pump weight goes up slightly.

Thursday afternoon, October 5
C. E. Stryker, *chairman*

Devoted entirely to production problems of aircraft, this session developed the importance of interchangeability of parts and major units to make line assembly possible. Also stressed was the need of breaking down the assembly

Engineers Jam Aircraft Engineering Display



Exhibitors, and engineering executives who flocked to the first SAE Aircraft Engineering Display, located in the foyer just outside of the meeting room, were enthusiastic in their approval. Twenty-two companies supplying the aircraft industry offered unique displays of the most modern equipment, parts, and materials.

Exhibiting at the various booths were: Aircraft Accessories Corp.; Aircraft Precision Products; Aluminum Co. of America; Aluminum Industries, Inc.; Baldwin-Southwark Corp.; Bantam Bearings Corp.; Bendix Products, Eclipse Aviation, and Stromberg Carburetor; Edward G. Budd Mfg. Co.; Cannon Electric Development Co.; Ducommun Metals & Supply Co.; Fafnir Bearing Co.

International Nickel Co., Inc.; Librascope, Inc.; Edward D. Maltby Co.; Norma-Hoffmann Bearings Corp.; Pyrene Mfg. Co.; Rohm & Haas Co., Inc.; SKF Industries, Inc.; Solar Aircraft Co.; United Aircraft Products, Inc.; S. S. White Dental Mfg. Co.; and the Wright Aeronautical Corp.

Among Those Present at the Aircraft Production Meeting

(Left to right): 1. B. W. Sheahan, Consolidated Aircraft Corp., being introduced at the Thursday evening session by T. P. Wright, Curtiss-Wright Corp.

2. E. V. Scott, Menasco Mfg. Co.; Mac Short, Vega Airplane Co., who was general chairman of the entire meeting; and C. A. Van Dusen, Consolidated Aircraft Corp.

3. Robert Insley, Pratt & Whitney Aircraft; Mrs. Mac Short; and SAE Vice-President William Littlewood, American Airlines, Inc.

4. Southern California Section Chairman E. W. Templin, chairman of the Banquet and Grand Ball.

5. Dr. O. C. Bridgeman, National Bureau of Standards; James B. Edwards, Douglas Aircraft Co., Inc.; H. C. Hill, Wright Aeronautical Corp.; Ivar L. Shogran, Douglas Aircraft Co., Inc.; Dr. A. L. Klein, California Institute of Technology; Harry Hjorth, Douglas Aircraft Co., Inc.; and Preston G. Smith, of the same company.

6. Dr. N. B. Moore, University of California; SAE Vice-President H. K. Cummings, National Bureau of Standards; and George W. Brady, Curtiss Propeller Division, Curtiss-Wright Corp.

operation into the greatest possible number of component parts in order to permit efficient work without crowding on the part of personnel, permitting final assembling of such sub-assembled units on a straight-line basis at relatively high speed.

Interchangeability in Modern Aircraft Production – *Courtney Hertel, Douglas Aircraft Co., Inc.*

While the aircraft manufacturer recognizes the inherent economy in the system of interchangeable manufacturing used in mass production of automobiles, he is not able to apply the same system to aircraft building due to lack of mass quantity, complex nature of the airplane's structure, extreme flexibility and great bulk of many parts of the airplane structure, Mr. Hertel brought out. With respect to aircraft mechanisms produced by conventional machine production methods, interchangeability is assured by tooling methods common to all industries. This paper dealt with the more complex parts of the structure, such as wing and fuselage, and the development of faired surfaces involving double curvatures. Such curves and outlines are laid out full scale in a lofting department but it is not practical for shop men to scale dimensions direct from such lofted outlines, as no two men would scale to the same identical dimension. Therefore tables of offsets and bevels are prepared by the lofting department to convert significant points on the molded surface into numerical values useful to engineering and tooling personnel. With a structure as large as the wing, a system of applied analytical geometry is used to calculate any point on the wing structure, which is treated as a geometric solid.

The Final Assembly of Aircraft – *H. F. Schwedes, North American Aviation, Inc.*

Final assembly of aircraft on a production basis has long been the dream of all connected with the industry. Until recently aircraft were so designed that it was necessary to concentrate a large number of men in the small fuselage space available during final assembly operations. The modern idea is to make engineering production-minded and by designing for production in the beginning make it possible to achieve efficient line assembly. This has been done at North American Aviation by designing a plane so that its various component assemblies, manufactured complete in jigs in several departments, are brought to final assembly completely finished, painted, and ready for assembly on the airplane without fitting or hand work. Thus outer wing panels are each built up from three or four sub-assemblies. The stabilizer and elevator, both right and left sides being identical, are assembled in separate jigs. The fuselage is built in two separate sections, in addition to the engine mount, and bolted together. Covered side panels for the fuselage are completed in separate jigs and are attached with screws after all fuselage installations are complete. The wing center section is assembled complete with tanks and landing gear before attaching to the fuselage. In order that the many parts and sub-assemblies manufactured under this system may all be ready for final assembly at the required time a detailed system of production control is maintained. This is based on lot production practise, starting with a preliminary lot of five or ten planes to complete tooling, checking of jigs, parts, etc., and then proceeding with production quantities of twenty planes in each lot. Actual final assembly is accomplished by moving the plane progressively through a set of stations, usually eight in number, with a special crew at each station trained for the work done there, and with tools and parts supply to permit maximum efficiency. By such methods North Amer-

ican Aviation has established what is believed to be a peacetime production record for a major manufacturer by turning out ten airplanes in one twenty-four hour period, 103 airplanes in a single month of 23 working days; and by averaging 74 airplanes per month for the first six months of 1939.

Accelerated Aircraft Production for National Defense – ***P. N. Jansen, Curtiss Aeroplane Div., Curtiss-Wright Corp.*** **(Read by T. P. Wright, Curtiss-Wright Corp.)**

Emphasizing the importance of industry to a scheme of national defense, and, under current conditions, the special importance of the aircraft industry, the author said that the question as to what extent industrial mobilization can aid the aircraft industry in producing large numbers of aircraft is one that needs clarifying. The time element and experience factor play a major part in any plane. Prototype aircraft must be produced under forced draft and with little attention to the details that will later be smoothed up in production. Thus fittings, eventually forged, may be hogged out of solid stock. Reaching the production phase on a new type can also be hastened, in an emergency, by purchasing direct from the drafting board, depending on testing of the prototype to smooth out design problems. Actual production should follow the lot system, with careful production control. Tooling must be based on a knowledge that there is little cost reduction in producing quantities greater than 100.

Discussion

The chairman read a written discussion sent by Ralph S. Damon, vice president in charge of operations, American Airlines, Inc., in which it was agreed that prototype development must be conducted under maximum pressure, and also that the maximum liaison must be maintained between shop and engineering departments. However, Mr. Damon felt that much greater attention should be given to inventory control.

Dr. A. L. Klein commented that many engineers have undertaken extreme simplification of the major structural components of an airplane, as in the case of recent plastic developments, in order to cut production costs; whereas it appears that production costs are largely attributable to installation of parts, accessories, and sub-assemblies. He felt that the molded plane must defeat its own purpose by making it more difficult to install such units.

Thursday evening, October 5
T. P. Wright, *chairman*

This session was devoted to problems of engineering experimental aircraft and stressed the speed with which prototype planes must be built to meet current rapidity of technological development, which has been known to render a prototype obsolescent before it could be placed in production. Quite astonishing, and from the military standpoint comforting, information was given the audience as to the speed with which recent planes have been developed from the time the go signal was given to the engineering department until the completed airplane was test flown. This ranged from a period of 88 days for the small Vultee trainer, to less than ten months for the giant new Consolidated Model 31 flying boat.

Engineering Experimental Aircraft – ***W. A. Hite, Vultee Aircraft Div., Aviation Mfg. Corp.***

Experimental engineering is the cornerstone of the aeronautical industry, this paper emphasized. While the engineering department is not responsible for sales, it must develop an article that can be profitably manufactured. Therefore the experimental engineering department must be cost and production-minded, as well as performance-minded. Speed in experimental engineering must be achieved largely through efficient engineering management, which brings together all the various developments within the industry that may bear on the perfection of a new plane. In developing the Vultee trainer all experimental engineering personnel were located adjacent to experimental loft, template, and final assembly departments. Designing for production simplicity also helped to simplify preliminary engineering and drafting work, and construction of the prototype plane. Considerable use of the drop hammer was made in developing the experimental plane. Major aids to production are found in: 1. Breaking the airplane into a number of parts for sub-assembly. 2. Maximum simplification of all portions of the structure.

Discussion

T. P. Wright commented that too rapid development of the prototype might lead to later production difficulties. But Mr. Hite thought this had been solved through the close collaboration of shop and engineering personnel in developing the experimental model. Stanley Bell, Hughes Aircraft Co., wondered if using the drop hammer on experimental work was not pretty expensive. On the contrary, Mr. Hite said, it had proved a fast and economical aid to development of the initial model, much superior to the old practice of hand bumping experimental parts.

New Method of Developing Prototype Airplanes as Applied to Consolidated Aircraft Corporation's Model 31 – ***B. W. Sheahan, Consolidated Aircraft Corp.***

Much of the time lost in developing experimental aircraft is due to delays from outside sources, according to the author. Much time can be saved, especially on government work, if the contractor is permitted to go ahead on his own responsibility, without too close collaboration on the part of the customer. In the case of the Model 31, Consolidated undertook this development as an independent project and so were able to push it through without any outside interference. Time was further saved by concentrating on designing and building the airplane proper, without too detailed attention to various accessories and installations which might later be applied in connection with specialized military or commercial service of the plane. The paper outlined in detail a new engineering and shop procedure which eliminated two-thirds of all working drawings.

Discussion

Dr. A. L. Klein suggested that there is much difference between rushing through an experimental plane, and getting that plane into production quickly. He thought the Consolidated loft board production method might not be generally applicable to immediate contract work. To this Mr. Sheahan replied that the loft board jigs accelerated production, as had already been proved in practice since the method was adopted. Brint Edwards, Douglas Aircraft Co., wanted to know how information for accessory installations was obtained without drawings. The author replied that sufficient drawings were made for this purpose, plus reference to the mock-up. T. P. Wright reported that a lofting section in the engineering department was conducted at the Buffalo plant of the Curtiss Aeroplane Co. along lines similar to those outlined. Mr. Sheahan stated, in response to a question, that approximately 1000 drawings were made during development of the Model 31.

Friday morning, October 6
Robert Insley, *chairman*

Devoted to engine problems and the CFR Vapor Lock Project progress report, this session introduced some little-known and intensely interesting design information concerning Ranger air-cooled, in-line engines on the one hand; and vital production information dealing with Wright radial air-cooled engines on the other hand.

Progress in the Development of Inline Air-Cooled Engines – ***A. T. Gregory, Ranger Engineering Corp.***

Delving deep into the scientific aspects of intake manifold tuning for maximum beneficial effect from pressure waves within the intake pipe, the problems of camshaft vibration, and other related engine matters, this paper came up with some information on progress in engine design which explains the rapid increase in acceptance which has been accorded the in-line type aircraft engine in recent years. Typical of progress is an increase in power by 50% in a five-year period, without weight increase. It was shown that proper proportioning of the intake manifold will produce a "pipe-organ" effect which actually supercharges the engine materially, increasing power as much as ten per cent, due to ramming action.

Discussion

Ashley C. Hewitt suggested that the single-sleeve-valve engine might eliminate all valve-gear troubles. The author thought this point debatable since "sleeve-valve engines are reported to have a set of problems of their own." Mr. Hewitt reported conducting a three-year development program on a sleeve-valve experimental engine, and said he had experienced trouble with almost everything but the valve gear.

Design Problems in the Quantity Production of Aircraft Engines – ***H. C. Hill, Wright Aeronautical Corp.***

The aircraft engine producer, this paper stated, faces three unique conditions which make quantity production a complex problem: (1) intensely rapid design development; (2) great pressure for perfection in reliability; and (3) an unusually large number of variables in the project. The author points out that these factors all emphasize importance of quality in the design engineering, with a special premium on simplicity. A major difficulty in achieving quantity production is the relatively large number of changes, found to average about ten changes for every eighteen engines built. Source of these changes is charted accurately. Various specific design improvements are discussed in detail as examples of service difficulties overcome through design changes. Also described was development of a forged steel crankcase, machined all over, which had been made as light and cheap to manufacture as the alloy case it replaced, with a considerable improvement in reliability. If production quantities are to be increased substantially further attention to improved design will be necessary, especially where the basic type is more complex than the present single-row radial air-cooled engine.

Discussion

A written discussion by Arthur Nutt, vice-president of engineering, Wright Aeronautical Corp., was read by the chairman. Mr. Nutt thought that multiplicity of inspections particularly by military customers, complained of by the author, tend to keep the manufacturer on his toes. He also felt that more careful specification of requirements would avoid much inspection controversy which has existed in the past. Application of the Profilometer and other methods of achieving exact specification of desired finishes and tolerances was suggested.

The question of oil consumption and other troubles such as fouling due to reversal of the oil ring, was raised from the floor. Mr. Hill replied that converting the scraper ring into a pumper had improved lubrication of the cylinder walls, while better oil control above the piston pin had actually reduced overall oil consumption. Ashley Hewitt wanted to know if

(Continued on page 21)

About SAE Members:

NORMAN N. TILLEY, who has been nominated as SAE vice-president representing Aircraft-Engine Engineering, has left the Aircraft Engine Division of Continental Motors Corp., Detroit, where he was chief engineer, to join the engineering staff of the Lycoming Division of Aviation Mfg. Corp., Williamsport, Pa.

CARL F. BACHLE, formerly research test engineer at the Aircraft Engine Division of Continental Motors Corp., Detroit, has been named assistant chief engineer in charge of research.

HAROLD G. SMITH, who was chief engineer of the Hercules Motors Corp., Canton, Ohio, from 1920 until early this year, is connected with the engineering and sales departments of the Buda Co., Harvey, Ill.

B. B. BACHMAN, vice-president and chief engineer, Autocar Co., Ardmore, Pa., has been appointed SAE representative on the reorganized Division of Engineering and Industrial Research of the National Research Council.

DR. FRANK ORVILLE CLEMENTS, whose retirement as technical director of the General Motors Research Laboratories was noted in the October SAE Journal, was honored at a dinner in Detroit, Sept. 21, by many of the men who had been his associates during his 19 years with the company. **CHARLES F. KETTERING** (left), GM vice-president in charge of research, who studied under Dr. Clements at Ohio State University, and who asked his aid in forming the Dayton Engineering Research Laboratories in 1917, presented him with a perpetual clock which winds itself with the change in barometric pressure. Other associates presented him with a metal statue designed and executed by Marshall Fredericks of Cranbrook Institute.

Dr. Clements has taken residence in Westerville, Ohio, the home of his alma mater, Otterbein College, where he will devote his time to aiding students who wish to help themselves through college.

Detroit Times photo

C. F. Kettering Dr. F. O. Clements

H. C. MOUGEY, who has been head of the general chemical department of the General Motors Research Laboratories, has been named to succeed Dr. Clements as technical director of the laboratories, Mr. Kettering announced at the dinner. Mr. Mougey was one of the first five men to join Mr. Kettering and Dr. Clements when the old Dayton Engineering Research Laboratory was established.

MAURICE MELHUISH, who has been joint managing director of the Glacier Metal Co., Ltd., Wembley, Middlesex, England, with which he had been affiliated for 20 years, recently was named governing director of Precision Bearings, Ltd., Greenford, Middlesex.

P. J. FLAHERTY, president, Johnson Bronze Co., New Castle, Pa., has been appointed to the vacancy on the board of directors of Glacier Metal Co., Ltd., left by Melhuish's resignation.

HEDLEY R. DREHER, who joined the Inland Mfg. Division of General Motors Corp. last summer, when it acquired the assets and business of the Bondall Co., with which he was affiliated, is supervisor of friction materials of the Inland Mfg. Division, with headquarters at Dayton.

GEORGE J. MEAD, vice-president and director of United Aircraft Corp., has been named by President Roosevelt to the National Advisory Committee for Aeronautics to fill the vacancy left by the resignation of Dr. Joseph S. Ames, president emeritus of Johns Hopkins University. Mr. Mead will complete Dr. Ames' unexpired term of five years from Dec. 1, 1938.

R. D. EVANS, formerly manager, passenger and truck tire design, tire testing, Goodyear Tire & Rubber Co., Akron, has been advanced to chief tire designer.

LEE C. CARLTON, formerly western division sales manager of the American Bosch Corp., has been named manager of the company's new sales and engineering service division, with headquarters at Springfield, Mass. **FOSTER N. PERRY,** who was manager of the eastern division, will succeed Mr. Carlton as western division sales manager. The new sales manager of the eastern division is **FRANK OBERLE,** formerly of the Springfield office.

JAY M. ROTH has been advanced from assistant chief engineer to chief engineer by the Pump Engineering Service Corp., Cleveland.

ARTHUR E. BAUSENBACH, formerly Chicago zone representative, John Bean Mfg. Co., is service engineer with the Kent-Moore Organization and the Hinckley-Myers Co. His headquarters are in Detroit.

JOHN K. RUDD, formerly a student at Princeton University, is with the Wright Aeronautical Corp., Paterson, N. J.

MAJOR D. C. LINGLE has been appointed to membership on the Aircraft and Screw Threads Divisions of the SAE Standards Committee to succeed **LT.-COL. H. W. FLICKINGER.**

ROBERT INSLEY, assistant chief engineer, Pratt & Whitney Aircraft, East Hartford, Conn., **WILLIAM LITTLEWOOD,** vice-president in charge of engineering, American Airlines, Inc., Chicago, **H. L. HIBBARD,** vice-president and chief engineer, Lockheed Aircraft Corp., Burbank, Calif., **DON R. BERLIN,** chief engineer, Curtiss Aeroplane Division, Curtiss-Wright Corp., Buffalo, N. Y., and **MAC SHORT,** president, Vega Airplane Co., Burbank, Calif., are among those recently elected as fellows of the Institute of the Aeronautical Sciences.

DR. PER K. FROLICH, director of chemical laboratories, Standard Oil Development Co., Elizabeth, N. J., has been re-elected chairman of the Petroleum Division of the American Chemical Society.

Southern New England Section's vice-chairman for aeronautics, **JOHN G. LEE,** has been advanced by United Aircraft Corp., East Hartford, Conn., to the post of assistant director of research in charge of the technical branch.

John G. Lee
Advanced

A. E. DAGNER has resigned as district manager of the White Motor Co. in Portland, Ore., and has formed the Fageol Motor Sales Co. in the same city, of which he is vice-president and general manager.

ROBERT E. HUNT has been appointed engineer in charge of research and product development by the Wilkening Mfg. Co., Philadelphia. He previously was in charge of engine development, Reo Motor Car Co., Lansing, Mich.

ARTHUR MONSON, a graduate of the Polytechnic Institute of Brooklyn, is a junior engineer in the automotive laboratories of Socony-Vacuum Oil Co., Inc., Brooklyn, N. Y.

FURBER MARSHALL, who was president of the Marshall Asbestos Corp., a subsidiary of Bendix Aviation Corp., is general manager of the successor company, the Marshall-Eclipse Division of Bendix Aviation Corp.

BRITTON L. GORDON is sales engineer with the Blackmer Pump Co., Grand Rapids, Mich., with headquarters in New York. Formerly he was with the Halowax Corp., Bloomfield, N. J.

FRANK S. ROOP, JR., who was instructor in mechanical engineering at Virginia Polytechnic Institute, Blacksburg, Va., has been advanced to assistant professor of mechanical engineering.

RICHARD H. VALENTINE has joined the engineering department of New Departure, Division of General Motors Corp., at Bristol, Conn. Previously he was secretary-treasurer of Van Alst Motors, Inc., Astoria, N. Y.

PHILIP G. JOHNSON has been elected president of both Boeing Airplane Co. and Boeing Aircraft Co., Seattle, Wash., according to **C. L. EGTVEDT,** former president, who has been elected chairman of both companies. In 1917 both Mr. Egtvedt and Mr. Johnson, former classmates at the University of Washington, joined the Boeing company as draftsmen in the engineering department, subsequently advancing to executive positions. Mr. Johnson is president of the Kenworth Motor Truck Corp., and will retain that post. He also is consultant for the Trans-Canada Air Lines of which he was vice-president in charge of operations for the past two years, and director of the Pacific National Bank, Boeing Airplane Co., and the Puget Sound Navigation Co., Seattle. In the past he has been president of United Air Lines, Inc., Pacific Transport, Varney Air Lines, Inc., and National Transport.

(*Continued on next page*)

CLARENCE H. SCHILDHAUER, since Oct. 1, has been sales manager, marine equipment, for the Glenn L. Martin Co., Baltimore, Md. Before this change he was operations manager of Pan American Airways' Atlantic division. In this capacity he was one of those aboard the giant Pan American flying boat "Yankee Clipper" on its initial survey flight to Europe, covering 11,000 miles between March 26 and April 16 of this year.

Clarence H. Schildhauer
To Martin

S. M. KRITSER has been advanced to flight engineer officer by Pan American Airways. His headquarters are at the Municipal Airport, Baltimore, Md. Mr. Krister was assistant engineering officer of the "Yankee Clipper" on its first transatlantic survey flight.

CHRIS BOCKIUS, development engineer, Raybestos-Manhattan, Inc., has been appointed a member of the SAE Brake Committee.

ROBERT P. VAIL, formerly an instructor on the engineering faculty of Texas Technological College, Lubbock, Texas, has been appointed assistant professor of mechanical engineering.

FOREST C. RANDALL, formerly with the Chevrolet Motor Division, General Motors Corp., Flint, Mich., has joined the Detroit Gasket & Mfg. Co., as dynamometer operator.

LEE M. BRANNAN is engineer at the stocker plant of Fairbanks, Morse & Co., Three Rivers, Mich. He was with the Perfect Circle Co., Hagerstown, Ind.

JAMES D. LESLIE, who graduated from the University of Detroit last June, is employed in the laboratory of the Ternstedt Mfg. Division, General Motors Corp., Detroit.

WILLIAM B. STOUT, president, Stout Engineering Laboratories, Inc., Dearborn, Mich., has designed a two-passenger cabin monoplane built of welded stainless steel to facilitate low-cost quantity production. The new plane, a modernized version of the Sky Car which he designed eight years ago, weighs 750 lb, is powered by a 70 hp air-cooled engine, and has a cruising speed in excess of 100 mph, it is reported.

CHARLES F. LIENESCH, owner, Air Agency, Los Angeles, who has been chairman and secretary of the Southern California Section, is with the Civil Aeronuatics Authority.

PAI SHIH-I, who recently graduated from the California Institute of Technology, returned to China late last month.

CLINTON BRETTELL has joined the engineering staff of Surface Transportation Corp., New York. For a number of years Mr. Brettell was superintendent of garages for R. H. Macy & Co., Inc. More recently he has been service manager with the Storch Leasing Corp., New York.

MICHAEL B. COMBERIATE, formerly inspector with the Sperry Gyroscope Co., Brooklyn, N. Y., is now junior marine engineer, Navy Department, Norfolk Navy Yard, Portsmouth, Va.

Since Oct. 1, **A. H. SUNDFOR** has been tool engineer with the Howard Aircraft Corp., Chicago. He formerly was with the International Harvester Co., Chicago, as research laboratory assistant.

PAUL N. FOX is inspector in the experimental department of the Glenn L. Martin Co., Baltimore, Md. He was affiliated with the Frances Fox Institute, New York.

ERNEST MOLNAR, formerly with the Buckeye Steel Castings Co., Columbus, Ohio, is draftsman with the Seagrave Corp., of the same city.

GEORGE A. PARKSTON has joined Morris Abrams, Inc., New York, as salesman. He was with the Delco Frigidaire Conditioning Division of General Motors Sales Corp. in Brooklyn, N. Y.

BYRON T. AASLAND, former designer with the David Bradley Mfg. Works, Bradley, Ill., has been advanced to assistant chief engineer of the company.

ROBERT L. STANLEY, who received his degree of Bachelor of Mechanical Engineering from Ohio State University in 1936, and his Master of Science degree from Rutgers University in June of last year, has been appointed an instructor in civil engineering at Union College, Schenectady, N. Y.

FRANK JARDINE, chief automotive engineer, Aluminum Co. of America, examines a new aluminum alloy bearing developed in the laboratories of the company under the joint direction of himself and L. W. Kempf, research metallurgist.

GUNNAR EDENQUIST is now chief engineer of Kinner Airplane & Motor Corp., Ltd., Glendale, Calif.

JEROME C. HUNSAKER, head of the department of mechanical engineering at Massachusetts Institute of Technology, has been elected a vice-president of the American Society of Mechanical Engineers. Dr. Hunsaker and other new officers will be installed at the 60th Annual Meeting of the ASME, to be held in Philadelphia, Dec. 4-8.

HENRY L. BILL, for some time vice-president and general manager of the Pioneer Instrument Co., Inc., a subsidiary of the Bendix Aviation Corp., has been elected president of United Aircraft Products, Inc., and will be located at the Dayton, Ohio, offices of the company.

GUY E. PARKER, who was assistant chief engineer of the Cadillac Motor Car Division of General Motors Corp., Detroit, is now connected with the sales department of the Motor Wheel Corp., Lansing, Mich.

C. C. BOHNER has been transferred from the Western Cartridge Co., East Alton, Ill., to the Winchester Repeating Arms Co., Division of Western Cartridge Co., at New Haven, Conn., where he is assistant sales manager.

Vol. 1 of **DR. GUSTAV EGLOFF's** book, "Physical Constants of Hydrocarbons," recently was published by the N. Y. Reinhold Publishing Corp. It covers paraffins, olefins, acetylenes, and other aliphatic hydrocarbons. Dr. Egloff is director of research, Universal Oil Products Co., Chicago.

CLYDE A. DIVELY, who was junior engineer with the Detroit Diesel Engine Division, General Motors Corp., is now with the International Harvester Co., Inc., Fort Wayne, Ind.

FREDERICK L. PARSONS is doing engineering layout work with the Wright Aeronautical Corp., Paterson, N. J. He was with the International-Plainfield Motor Co., Plainfield, N. J.

WILFRED C. OESTRIKE, formerly junior engineer, Packard Motor Car Co., Detroit, is in the engineering department of Allison Engineering Co., Division of General Motors, Indianapolis.

PRESCOTT C. RITCHIE, advertising manager, Waukesha Motor Co., **JOHN F. CREAMER,** president, Wheels, Inc., and **MERRILL C. HORINE,** sales promotion manager, Mack Mfg. Corp., are among those named to the publicity committee of the sixth annual National Motor Truck Show, to be held in Chicago, Nov. 8-16, according to **JOHN F. WINCHESTER,** president and general manager of the show.

Walter M. Jones

Walter M. Jones, eastern representative of the Waukesha Motor Co., Waukesha, Wis., died suddenly on Aug. 31, while attending a business conference in Pittsburgh, Pa. He became a member of the SAE in 1911.

The greater part of Mr. Jones' life was spent in the automotive industry. He had been affiliated with the Sheldon Axle & Spring Co., the Timken-Detroit Axle Co., and the Indiana Truck Corp.

Mr. Jones was born in Ironton, Ohio, in 1887. At the time of his death he was a resident of West Orange, N. J.

W. J. Sommers

W. J. Sommers, executive of the White Motor Co., with headquarters in Long Island City, died on Oct. 10 while on board his yacht "Francelia" in Manhasset Bay, off Long Island. He was 51 years of age and had been a member of the Society since 1925.

After graduating from Lehigh University with the degree of Mechanical Engineer in 1909, Mr. Sommers went to work for the Mack Bros. Motor Co. In 1911 he joined the New York Telephone Co., and stayed with that company as supervisor of motor vehicles until 1915. In that year he started with the White Motor Co., and was continuously affiliated with that organization until his death.

Sam W. Hardee

Sam W. Hardee, vice-president, Universal Motor Oils Co., Wichita, Kansas, died Aug. 19, from injuries received in an automobile accident. He was 30 years old and had been an associate member of the Society since March, 1938.

After graduating from Sulphur High School, Sulphur, Okla., and attending Oklahoma Agricultural and Mechanical College for one semester in 1927, Mr. Hardee joined the Universal Motor Oils Co. He compounded lubricants and did sales work for 5 years before advancing to the post of vice-president.

Since mid-September **ROBERT C. McGUIRE** has been engineer with the Seversky Aircraft Corp., Farmingdale, Long Island, N. Y. He formerly was junior engineer with the United Air Lines Transport Corp., Chicago.

NORBERT D. McCUE, who was manager of the automotive department, Kroger Grocery & Baking Co., Chicago, now owns the Motor Transport Lines, of the same city.

R. L. DICKINSON, who has received his M.E. degree from Ohio State University, where he was an active member of the SAE Student Branch, is graduate assistant at Purdue University, West Lafayette, Indiana.

HUMPHREY F. PARKER has been advanced to chief engineer of the Columbus-McKinnon Chain Corp., Tonawanda, N. Y. He formerly was development engineer.

ANSEL N. MORTON has been named factory superintendent of the International-Plainfield Motor Co., Plainfield, N. J. Previously he was chief inspector.

NATHAN R. ROSENGARTEN, formerly a student at the Drexel Institute of Technology, is with the Pratt & Whitney Aircraft, East Hartford, Conn., as detailer and draftsman.

WILLIAM F. SHERMAN, SAE Journal field editor and Detroit editor of *Iron Age,* is a seasoned glider. When competing in the recent American Open Soaring Meet at Frankfort, Mich., he was one of several to land in Lake Michigan. Fortunately the ducking did little damage to either Mr. Sherman or his glider. After this adventure Mr. Sherman was welcomed to membership in the Dunkers' Club, one of the most exclusive organizations extant, and was presented with the club's symbol, a vial of Lake Michigan water.

ELLIOTT W. STEWART, vice-president of the Wm. D. Gibson Co. Division of Associated Spring Corp., Chicago, recently was named director of product engineering.

On Michigan-Life Program

SAE members will be prominent at the Michigan-Life Conference on New Technologies in Transportation, sponsored by the University of Michigan College of Engineering, division of transportation, and Life Magazine, at Ann Arbor, Nov. 1-3. On the program, among others, are: CHARLES F. KETTERING, vice-president in charge of research, General Motors Corp.; PROF. GEORGE GRANGER BROWN, University of Michigan; D. A. WALLACE, president, Chrysler Sales Corp.; PROF. EDWARD A. STALKER, head of the department of aeronautical engineering, University of Michigan; FRED M. ZEDER, vice-chairman of the board, Chrysler Corp.; DR. GUSTAV EGLOFF, director of research, Universal Oil Products Co.; PROF. WALTER E. LAY, University of Michigan; and A. J. SCHAMEHORN, director, General Motors Proving Ground.

About Authors

(*Concluded from page 9*)

of Prague, which later awarded him the degree of Doctor of Engineering, he continued his studies at École Supérieure d'Aéronautique in Paris. After gaining experience in testing with Hispano-Suiza and Lorraine-Diétrich, he conducted testing and research work on engines at the famous Skoda Works, and later did flight testing and development work on Dewoitine airplanes. In America from 1927 to 1931, he was on the engineering staff of the Glenn L. Martin Co., then the General Airplanes Corp., and project engineer with the Detroit Aircraft Corp., Lockheed Division.

• **George L. Neely** ***(M '35) has designed and put into operation a large amount of automotive testing equipment. He is a graduate of the United States Naval Academy at Annapolis, and served several years as an ensign in the United States Navy before he joined the Standard Oil Co. of Calif., with which he is now research engineer in charge of fuels and lubricants. He is a member of the SAE Council and a past-chairman of the Northern California Section, which he also has represented on the Meetings and Sections Committees of the Society. He has been active on SAE technical committees for a number of years, participating in this work even before becoming a member of the Society.***

Applications Received

The applications for membership received between Sept. 15, 1939, and Oct. 15, 1939, are listed herewith. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

Baltimore Section

ADLER, CHARLES, JR., traffic research engineer, Mt. Royal Station, Baltimore.
ELLINGTON, FRANK GROSS, president, Everel Propeller Corp., Baltimore.
PAYNE, WARREN G., associate M.E., U. S. Naval Engineering Experiment Station, Annapolis, Md.

Chicago Section

KEENAN, ARTHUR H., sales engineer, Federal-Mogul Corp., Chicago.

Cleveland Section

CHURCH, JEROME A., laboratory technician, B. F. Goodrich Co., Akron, O.
JACK, WILLIAM R., treasurer and sales manager, Pump Engineering Service Corp., Cleveland.
MARSHALL, FRED F., field representative, Pump Engineering Service Corp., Cleveland.
VOGT, W. W., chief compounder, The Goodyear Tire & Rubber Co., Akron, Ohio.

Detroit Section

BELL, EARL O., plant engineer's assistant, Aluminum Co. of America, Detroit.
CHAPIN, LAMBERT, junior engineer, Chrysler Corp., Highland Park, Mich.
CHURAN, PAUL ROBERT, chassis and motor draftsman, Hudson Motor Car Co., Detroit.
HASTINGS, REEVE R., junior engineer, Detroit Diesel Engine Division, General Motors Corp., Detroit.
INGRAM, WILLIAM T., experimental engineer, Chrysler Corp., Detroit.
KNOX, DAVID R., chief engineer, Bundy Tubing Co., Detroit.
MCKENZIE, CHARLES STUART, mechanical drawing teacher, Port Huron High School, Port Huron, Mich.
MCLAINE, JOHN A., experimental engineer, American Brakeblok Division, The American Brake Shoe & Foundry Co., Detroit.
REESE, C. J., president, Continental Motors Corp., Detroit.
RUMELY, EMMET SCOTT, student training course, Ford Motor Co., Dearborn.
STEHLE, KENNETH LOUIS, student engineer, Electric Auto-Lite Co., Toledo, O.

Indiana Section

NEWCOMBE, JOHN WADE, chief chemist, D. A. Lubricant Co., Indianapolis.

Metropolitan Section

BOUMAN, JOHAN HOEGH, time study department, United Parcel Service, New York.
BRITTON, ERNEST WILLIAM, test engineer, Wright Aeronautical Corp., Paterson, N. J.
BROWNE, KENNETH ALAN, project engineer, Wright Aeronautical Corp., Paterson, N. J.
BURDEN, WILLIAM A. M., vice president and director, National Aviation Corp., New York.
CHARSHAFIAN, JACK O., senior test engineer, Wright Aeronautical Corp., Paterson, N. J.
CUSHMAN, MAURICE E., stress analyst, Curtiss Propeller Division, Curtiss Wright Corp., Clifton, N. J.
GOLDSMITH, RICHARD, president, treasurer, B. G. Corp., New York.
HERRMANN, EDGAR R., designing engineer, The Heil Co., Hillside, N. J.
KASSCHAU, KENNETH, test engineer, Wright Aeronautical Corp., Paterson, N. J.
LOEB, CARL M., JR., vice-president, Climax Molybdenum Co., New York.
MATZ, CHARLES W., teacher, auto theory, Board of Education, New York.
NOLF, WILLIAM RAYMAN, production planning, Wright Aeronautical Corp., Paterson, N. J.
NOOGER, SAMUEL, engineering aide, Postal Telegraph Cable Co., New York.
OTTO, EVERETT W., automotive engineer, Standard Oil Co. of N. J., Newark, N. J.
QUIMBY, ELLIS S., general manager, J. L. Quimby & Co., New York.
RITTER, HERBERT R., president, Ritter Trucking Co., Belleville, N. J.
VERRATTI, ALFRED J., dynamometer operator, Gulf Oil Corp., New York.

Milwaukee Section

KIEKHAEFER, E. G., vice president and general manager, Kiekhaefer Corp., Cedarburg, Wis.
ROMBERG, HENRY E., chief body draftsman, Seaman Body Corp., Milwaukee.
SCHNEIDER, LEONARD GUSTAV, instructor, steam and gas engineering, University of Wisconsin, Madison.

Northern California Section

GLOVER, THOMAS O., bus foreman, Board of Education, San Francisco.
WITHINGTON, CHESTER ALBERT, JR., research and development department, Tidewater Associated Oil Co., Associated, Calif.

Philadelphia Section

COTÉ, OLIVER HENRI, JR., junior aero engineer, U. S. Naval Aircraft Factory, Philadelphia.
WEISS, IRWIN KOEHLER, junior engineer, Atlantic Refining Co., Philadelphia.

St. Louis Section

WIEGAND, PHILLIP JOHN, JR., instructor of metals, Parks Air College, E. St. Louis, Ill.

Southern California

BEARDSLEE, L. L., superintendent of shops and garage, County of Los Angeles, Los Angeles.
GLASS, SIDNEY, draftsman, Lockheed Aircraft Corp., Burbank, Calif.
NEMOY, WILLIAM, production control, Menasco Mfg. Co., Los Angeles.

SMITH, GARDNER, district manager, Toledo Steel Products Co., Glendale, Calif.
WILSON, O. KENNETH, aero drafting instructor, Aero. Industries Technical Institute, Los Angeles.

Southern New England Section

ANDERSON, LIEUT. W. L., U. S. Navy, Submarine Base, New London, Conn.
BEYE, WILLARD R., test engineer, Hamilton Standard Propellers, E. Hartford, Conn.
KNIBLOE, STANLEY A., valve assembler, Consolidated Ashcroft Hancock Co., Bridgeport, Conn.

Tulsa Group

OLMSTEAD, EDWIN H., mechanical engineer, Well Surveys, Tulsa, Okla.

Washington Section

LOWRY, JOHN G., junior aeronautical engineer, National Advisory Committee for Aeronautics, Langley Field, Va.
PASS, HERBERT RALPH, junior engineer, National Advisory Committee for Aeronautics, Langley Field, Va.

Outside of Section Territory

CAMMEN, MATTHEW M., engineering department, Ingersoll-Rand Co., Painted Post, N. Y.
CLOUD, HAROLD W., manufacturing planning engineer, Sealed Power Corp., Muskegon, Mich.
SNOWDEN, BYRON S., transportation manager, General Ice Cream Corp., Schenectady, N. Y.
STANLEY, ROBERT LEROY, instructor in engineering, Union College, Schenectady, N. Y.
STIMSON, GLEN HAZELTON, gage sales manager, Greenfield Tap & Die Corp., Greenfield, Mass.

Foreign

CROCKETT, ROBERT JOHN, works manager, National Motor Springs Pty., Ltd., Alexandria, New South Wales, Australia.
HARRIS, CHARLES ALFRED HARRY, area engineer, Birmingham & Midland Omnibus Co., Ltd., Birmingham, England.
KING, THOMAS D., industrial salesman, Shell Oil Co., Inc., Honolulu, T. H.

New Members Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between July 15, 1939, and Aug. 15, 1939.
The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (SM) Service Member; (FM) Foreign Member.

Baltimore Section

SCHELL, FRED H. (A) sales promotion manager, Black & Decker Mfg. Co., Towson, Md.

Buffalo Section

BERLIN, DON R. (M) chief engineer, Curtiss Aeroplane Division, Curtiss-Wright Corp., Buffalo, N. Y.

Chicago Section

BUCKLEY, EDWARD T. (A) manager, trucking department, Cudahy Packing Co., 221 N. LaSalle St., Chicago (mail) 121 S. Grove, Oak Park, Ill.
CHAPMAN, EDMUND EARLE (M) mechanical assistant, Atchison, Topeka & Santa Fe Railway, 1032 Railway Exchange, Chicago.
DANN, WILLARD J. (M) mechanical inspector, C B & Q R. R., 547 W. Jackson Blvd., Chicago.

Cleveland Section

MADOLE, GEO. M. (A) assistant to general sales manager, Original Equipment Tire Division, B. F. Goodrich Co., 500 S. Main St., Akron, O.
NATIONAL BRONZE & ALUMINUM FOUNDRY CO. (Aff.) E. 88th St. & Laisy Ave., Cleveland. Representative: Schmeller, John L., sales manager.

Detroit Section

BOWMAN, LEO P. (A) inspection foreman, Chrysler Corp., 12200 E. Jefferson Ave., Detroit.
FLEMING, A. M. (M) general works manager, Chrysler Corp., Chrysler Division, Detroit (mail) 843 University Place, Grosse Pointe, Mich.
MITCHELL, CLYDE H. (A) district manager, sales division, Gates Rubber Co., 999 S. Broadway, Denver, Colo. (mail) 1448 Wabash, Room 800, Detroit.

Indiana Section

UNITED COOPERATIVES, INC. (Aff.) 733 W. Henry St., Indianapolis. Representative: Smoots, H. W., general manager.

Kansas City Section

BERG, HAROLD R. (A) division manager, Ethyl Gasoline Corp., 1917 Buchanan St., North Kansas City, Mo. (mail) Box 7436.
TOMLINSON, DANIEL WEBB, 4TH (M) chief engineer, Transcontinental & Western Air, Inc., 10 Richards Road, Municipal Airport, Kansas City, Mo.

Metropolitan Section

CREMER, GEORGE DORLAND (J) 11 Hillcrest Drive, Pelham Manor, N. Y.
INGALLS, DAVID BAGBY (J) engineer, Titeflex Metal Hose Co., 500 Frelinghuysen Ave., Newark, N. J.
KINSEY, ROBERT SHERWOOD (J) experimental tester, Wright Aeronautical Corp., Paterson, N. J. (mail) Beech Terrace, Pines Lake.

Milwaukee Section

DOBROGOWSKI, DANIEL T. (J) apprentice mechanical engineer, maintenance work, Milwaukee Stamping Co., 824 S. 72nd St., West Allis, Wis.

St. Louis Section

DUNNING, EDWARD (M) automotive engineer, Shell Oil Co., Inc., 13th & Locust Sts., St. Louis, Mo.

Southern California Section

JIRSA, LARMON LEO (J) power plant installation engineer, Vultee Aircraft, Downey, Calif. (mail) 4505 11th Ave., Los Angeles.

Outside of Section Territory

MCLEAN, ERROL BOYD (A) supervisor, Ewa Plantation Co., Ewa, Oahu, T. H. (mail) P. O. Box 151.

Foreign

NUKII, HARUKAZU (F M) superintendent, service and maintenance, Kongo Motor Car Co., 560-4 Chome Minami Sunamachi, Jotoku, Tokyo, Japan.
ZUMSTEG, ERNEST JOSEPH (F M) service manager, N. V. General Motors Java, Handel Mij., Tandjong-Priok, Java, N. E. I.

New Standards Division On Aircraft Materials

Acting favorably upon the request of the Engine Technical Committee of the Aeronautical Chamber of Commerce of America, that the work carried on for the past year by its subcommittee on aircraft materials specifications be continued by the Society of Automotive Engineers, the SAE Council approved the formation and the personnel of an Aircraft Materials Division of the Society's Standards Committee.

Development of standard aircraft and aircraft-engine material specifications, to relieve the Government and other purchasers of the necessity of approving different sets of specifications from the various manufacturers, and so that standard specifications will be available for use by all aircraft and engine manufacturers is the aim of the new Division. Material specifications will be written with the idea that they can be used for aircraft engines, propellers, accessories, and the aircraft itself.

B. Clements, Wright Aeronautical Corp., is chairman of the new Division, and H. J. Fischbeck, Pratt & Whitney Aircraft, is vice-chairman. Others originally appointed are: C. E. Carrigan, Ranger Engineering Corp.; R. L. Heath, Allison Engineering Co.; J. R. Hoven, Continental Motors Corp.; H. M. McFadgen, Jacobs Aircraft Engine Co.; R. D. Zonge, Aviation Mfg. Corp.; P. V. Faragher, Aluminum Co. of America, chairman of SAE Non-Ferrous Metals Division; and F. P. Gilligan, Henry Souther Engineering Co., chairman of the SAE Iron and Steel Division.

The new Division held its initial meeting in New York on Oct. 16 and 17, together with a special group of steel manufacturers' representatives, at which the group of proposed aircraft steel specifications was brought nearer to completion.

Extension of Junior Age Limit Approved by Council

At its meeting of Sept. 22, the SAE Council approved the Grading Committee's recommendation that the age limit for junior members to transfer to either associate or member grade be increased from 30 to 35 years. As this would necessitate a change in the Society's Constitution, the Council voiced its approval with the understanding that the matter would be called to the attention of the Constitution Committee for suitable handling.

Changes in industrial conditions which, in many instances, have made it impossible for junior members of the Society to gain sufficient experience to make them eligible for member grade upon becoming 30 years of age, was one of the major reasons for this change set forth by the Grading Committee in its presentation to the Council.

Team Picked for Debate With Kansas State College

• U. of Oklahoma

The forthcoming debate with the Kansas State College, to be one of the highspots at the SAE National Fuels & Lubricants Meeting at Tulsa, Nov. 2-3, occupied the greater part of the University of Oklahoma Student Branch Meeting, Oct. 4.

Leon Loudermilk, James Billings, Merle Lucas (chairman of the Branch), and George Stephenson were chosen for the Student Branch team which will take the negative on the question, "Resolved: That V-Type Engines are to be Preferred to In-Line Engines for Passenger Car Equipment," while Kansas State College representatives will uphold the affirmative.

John D. Taylor was elected secretary-treasurer of the Branch.

Aircraft Production Meeting

(*Continued from page 16*)

oil flow through the connecting rod bearing had been reduced through use of the end seal described in the paper. Mr. Hill said that the flow had dropped about 50% without affecting bearing lubrication, and that even further reduction in flow might be anticipated. Dr. A. L. Klein, commenting on the engine design problem, remarked that engine units must be made more compact and at the same time more accessible; that provision must be made for more accessories, and that these accessories must be more readily accessible and removable. Much design work remains to be done along such lines, said Mr. Hill. William Littlewood, American Airlines, said another solution of the oil cleaner problem was to hook it up to the oil cooler shutter control so that the pilot could manually clean the filter at any time through pumping the shutter control. The automatic cleaner might become inoperative under some conditions, but with the manual device it is always possible to keep the oil system open. Hill thought this idea a good compromise as a solution for this particular problem.

Investigation of Vapor Lock in Aircraft Fuel Systems; CFR Progress Report – ***Dr. O. C. Bridgeman, director, CFR Vapor-Lock Project.***

Dr. Bridgeman spoke extemporaneously on this subject, saying that work had not yet progressed to a point where positive findings could be reported so he preferred to keep his remarks general and did not want to be interpreted as giving a conclusive statement on any phase of the problem. Vapor lock usually occurs at the fuel pump inlet or at the carburetor, as these are points of lowest pressure, he said. Vapor lock is not a serious problem at operating altitudes below 10,000 ft. but becomes a major operating factor above 20,000 ft. Three factors must be considered: (1) fuel, (2) design of fuel system, and (3) operation. Although no conclusions can be made at this time it is obvious that a fuel system with high vapor handling capacity will suffer least from vapor lock. Various possible remedies for vapor lock include: (1) system with low pressure drop; (2) elimination of heat around the fuel system; (3) use of fuel coolers; (4) use of pump with high vapor handling capacity; (5) use of short fuel lines, sloping continuously back up to the fuel tank, to carry vapor back to the tank; and (6) possible use of a supercharged system, including placing of tank, pump, and carburetor all under pressure.

Discussion

Dr. A. L. Klein thought that fuel cooling should be simple with the new integral fuel tanks in which tank surfaces are in direct contact with the outer air. Dr. Bridgeman replied that experience showed some heating often took place with such tanks due to flow over them of hot exhaust gases, and in any case fuel did not cool rapidly after leaving the ground, even where integral fuel tanks are used. William Littlewood wanted to know if cooling the fuel in the tanks would produce carburetor icing with the new non-icing carburetors. The speaker had no conclusive knowledge, but felt this was still open to investigation.

Friday afternoon, October 6
H. K. Cummings, *chairman*

Two papers at this session were devoted to the somewhat futuristic conception of submerged engine installations in which the powerplants would be carried entirely inside the wing. It was shown that the only advantage of such an arrangement is the expectation of a speed improvement on the order of 7 to 8%. There are numerous design and operating problems both as to engine installation and propeller drive.

Problems of Submerged Engine Installations – ***W. E. Beall and E. G. Emery, Boeing Airplane Co.*** **(Presented by Dr. N. B. Moore, in charge of Aeronautics, University of California.)**

The paper was in very general terms because it deals with engines and aircraft designs of a confidential and restricted nature. The many problems raised by submerging powerplants within the airplane wing are set forth in detail in the hope that the entire aircraft industry may seek satisfactory solutions in the minimum time. While none of the problems are felt to be insurmountable they are of a major nature. Only gain is on the side of speed, whereas the submerged mounting is more costly, heavier, less accessible, and possibly not as safe due to increased fire hazard and increased danger to the primary structure of the airplane in event of engine or propeller failure. Detail problems concern the aerodynamic form of the wing enclosing the engine compartment, design of a satisfactory propeller shaft, satisfactory and safe disposal of exhaust gases, cooling of the engine, supercharged air, accessories, oil, and exhaust gas disposal system. All studies made to date are based on liquid cooled engines of new type with a greater number of cylinders than engines now in use, and differently disposed. In general, no solutions were indicated for the problems raised.

Discussion

James B. Edwards, Douglas Aircraft Co., wanted to know why this paper had not discussed air-cooled engines. Mr. Moore could not answer this question directly, but thought the assumption had been made that air-cooled engines were not applicable to such installations. The suggestion was made that the new type twin-row radial air-cooled engine with extension propeller shaft be mounted in a semi-submerged position back against the front spar of the wing. The speaker had no comment on such an experiment, but T. P. Wright reported he had seen a Bristol Blenheim bomber in England fitted with special engines having a 14-in. propeller shaft extension, and suitable improvement in cowling. The result was pleasing to the eye and gave the appearance of 5-10 mph more speed, but careful flight tests showed no gain whatever. On the other hand a single-engine Spitfire gained 10-12 mph through proper application of cuff fairings to the propeller hubs. In this case the propeller was of wood. Dr. A. L. Klein commented that we might be very disappointed in results obtained with the new long-nose radials as it was his observation from photographs of the German plane that holds the world speed record, that the engine was enclosed within a cylindrical cowl with a front opening of approximately 85% of the frontal area, and with no propeller shaft extension at all, the propeller operating right back against the engine and cowling. The chairman read a prepared discussion submitted by Arthur Nutt, voicing some doubt as to the desirability of submerged engine installations, especially as to safety factors in event of failures. Although the performance calculations have indicated an improvement in speed for the submerged engine installation, Mr. Nutt said, only an actual flight check can prove this statement, which must until then remain open to doubt. It is to be hoped that full scale flight tests will soon be made of aircraft with fully submerged engine.

Propeller Requirements for Submerged Engine Installation – ***George W. Brady, Curtiss Propeller Div., Curtiss-Wright Corp.***

Although the general form and arrangement of the propeller is not changed by submerged engine installations, certain special requirements are introduced. These include very small nacelles to house the propeller support and drive shaft, which will require special means to reduce drag of the propeller hub and shank. Structural problems are also increased by the small size of the support nacelle and by the vibration problems to be faced in such a propeller-shaft-engine unit. It is possible that through mounting the propeller away from the engine the problem of vibration may be greatly reduced, permitting corresponding reduction in propeller weight, which might then be devoted to a satisfactory drive shaft and support system without undue overall weight increase. The magnitude of the aerodynamic problem concerned with hub drag is illustrated by a study of a 1200 hp propeller at speed of 300, 400, and 500 mph with round and faired blade shanks, the figures being based on a three-blade propeller with power absorbed between the 12-in. and 24-in. stations, comparing a fineness ratio of one for the round shank and two for the faired shank. The study shows that fairing will save 27 hp at 300 mph, 86 hp at 400 mph, and 316 hp at 500 mph.

Discussion

James B. Edwards asked why the flexible shaft drive had not been considered in the paper, to which Mr. Brady replied that a flexible shaft drive was not properly a propeller problem and so did not come within the scope of his investigation. H. A. Patterson, North American Aviation, asked whether the spinner for a shaft driven propeller should be developed by the airplane manufacturer, or supplied by the propeller builder. While there is some structural advantage in having the spinner built and tested along with the propeller, Mr. Brady felt that the spinner design was primarily a function of the airplane builder. Carlos Wood, Douglas Aircraft Co., suggested that on present type radial engines the hub cuffs discussed in this paper would aid engine cooling materially, in addition to giving some performance improvement. Ashley Hewitt wanted to know how close the propeller disc can be brought to the wing leading edge in the case of submerged engine installations. It was Mr. Brady's opinion that, especially with relatively thin wings, the propeller could be brought back fairly close to the leading edge.

Saturday morning, October 7
Brint Edwards, *chairman*

The closing session of the production meeting quite properly was devoted to a consideration of production and properties of the two metals most widely used in aircraft manufacturing; magnesium and aluminum.

Production of Magnesium Alloy Aircraft Parts – ***L. B. Grant, Dow Chemical Co.***

Although the use of magnesium alloys in aircraft construction has advanced rapidly in recent years, Europe has made even greater progress than America and we may expect to see a wider application of this material in this country. Procedures incidental to working magnesium alloys are not unduly difficult or complicated, but should be well understood and followed to obtain satisfactory results. Corrosion is not at all the problem that some had thought and very satisfactory service is being given under even the most difficult conditions of exposure. Fire, likewise, has been overrated as a bug-a-boo.

Discussion

A. L. Walton, Douglas Aircraft Co., inquired if magnesium could be used near the exhaust system where a temperature of 300 F might be encountered. Mr. Grant reported that the material would lose strength somewhat at that temperature, but would maintain a high corrosion resistance to the effect of exhaust gases.

James Moffat, Aluminum Co. of America, asked whether magnesium drop hammer dies were made in the same way as the familiar lead and zinc dies. Mr. Grant thought some coring out of the back of the die would be desirable to save weight, although magnesium dies of 15-1600 lb have been made. He thought there would be some problem in pouring the male die directly in the female die as is done with the zinc and lead dies. G. D. Welty, Aluminum Company of America, reported seeing such magnesium dies in Europe recently and thought that both dies were made from a wood pattern and then hand shaped.

H. O. Simmons wanted to know if beryllium improves the properties of magnesium. To this Mr. Grant replied it was difficult to discover, inasmuch as beryllium is relatively insoluble in magnesium. A. L. Klein inquired if magnesium sheet scrap could be used to melt up with magnesium die metal, but Mr. Grant reported that the shrink characteristics of the sheet alloy were unsatisfactory for casting. Does magnesium resist the corrosion of fuel systems satisfactorily? asked J. P. Benjamin, Douglas Aircraft Co. Hundreds of hours service in carburetors and other parts in constant contact with fuels was reported for magnesium alloy parts by Mr. Grant. Mr. Benjamin asked about casting warp control with magnesium and Mr. Grant reported it is just about the same in this respect as aluminum alloys. Each casting presents individual problems. Long thin castings are subject to some corrective straightening. Curtis L. Bates, Aero I.T.I., just returned from a tour of Europe, reported that we are considered very backward in our adoption of alloys of magnesium, and wondered why this should be so. It was the opinion of Mr. Grant that shop inertia opposed to any process changes was the primary reason. This is rapidly being corrected through dissemination of information on working magnesium. E. C. Frost, Lockheed Aircraft Corp., asked about the abrasion resistance of magnesium corrosion treatments and was told that such treatments are soft, will not withstand abrasion, and must be protected during manufacture. G. R. Noble, Douglas Aircraft Co., thought the fire hazard fear had created sales resistance, to which Mr. Grant replied with information on how difficult it is to burn magnesium, although he felt we must limit applications of magnesium to proper locations. Frank Wallace, Harvey Machine Co., asked if magnesium alloys could be used on air-cooled engine cylinder heads, but Mr. Grant thought this an unsuitable application. Mr. Reed, of Electromatic Propeller Co., asked if magnesium alloys were satisfactory for propeller blades. Although little research has been conducted in this country along such a line, Mr. Grant thought the material could be used to advantage in this way. H. O. Simmons reported extensive use of magnesium propeller blades in both France and England.

Aluminum—Its History, Its Present and Future Place in Industry – ***G. D. Welty, Aluminum Co. of America.*** **(Illustrated with motion pictures.)**

Speaking without notes, G. D. Welty sketched in fascinating style the history of development of the various processes for extracting aluminum from its ores. Aluminum producers, he said, originally had to go into manufacturing enterprises in order to get their material adopted in competition with iron and copper. Growth of the automobile brought wide use of aluminum, although it has since become a minor factor in automobile design. New uses for aluminum and its alloys continue to be developed, and new alloys and processes perfected. Although aluminum has already been displaced in some applications by stainless steel, magnesium, plastics, and other materials, beryllium alloys of aluminum are a promising development and other improvements will doubtless help this metal keep its wide popularity for many years to come.

National Tractor Meeting

(Continued from page 12)

is often reduced when such oil is used. Others claimed that oil containing other ingredients frequently proves of little benefit to the engine, and that the best engine operation results from use of the best design in filters and of the best quality of lubricating oil. "A very effective oil filter is not effective if engine is not designed to help keep contaminating elements out," Frank Schluckfield, Continental Motors Corp., opined.

It was also the contention of some that asphaltic conditions of oil are being overstressed, and that it is not the duty of a filter to keep this contaminant out, but rather to keep the oil free from other dirt and dust.

Discussion also revealed that oil men think the oil filter manufacturers should produce a filter which will keep oil in good lubricating condition, while filter manufacturers contend that it is up to the oil producers to market a product which will withstand the wear and tear of use without breaking down as rapidly as some oil does at present.

The tour through the frame department of the A. O. Smith Corp. included an inspection of the corporation's Science Building, where all of the numerous products manufactured by the company were on display for inspection. Guides took groups of about 15 persons through the frame department explaining each step of production from the first welding of strips into portions of frames through to the completed frame and painting.

Inception and development of the "Superfinish" process now in general use by Chrysler was described at the National Tractor Meeting dinner Thursday evening by David A. Wallace, president, Chrysler Sales Division, Chrysler Corp., and A. M. Swigert, Jr., in charge of production research.

Contention of the speakers that a smooth surface, such as is defined by Superfinish, is a better oil adhering surface than a rougher surface, was the subject of considerable argument at the conclusion of the talk and during the remainder of the two-day meeting among those attending.

Internal cooling with oil and control of its temperature was the primary thought in a paper, "Temperature Control of Oil Used as a Lubricant and Internal Coolant," presented by F. M. Young, president, Young Radiator Co. He pointed out that high oil consumption, bearing failures, excessive oxidation, and ring sticking may result from too high oil temperatures.

Mr. Young pointed out, however, that the relation of these difficulties to the oil cooling problem is complicated. In the first place very little deterioration of the crankcase oil will probably occur at relatively high crankcase temperatures such as 300 F. Deterioration and oxidation actually occur at local points where temperatures may be as much as 200 F in excess of this figure, he explained.

"Where these high temperatures do occur, however, it is true that each of the difficulties cited may be experienced. Oil consumption, for example, may be increased, not only through excessive throw-off from the bearings, but also through evaporation of the lighter fractions of the oil where light lubricants are used. The various forms of oxidation which are responsible for bearing corrosion, ring sticking, etc., also probably occur at high elevated temperatures," Mr. Young said.

It appears obvious, he continued, that reduction of these difficulties by the use of oil coolers must be accompanied by full recognition of the ability of the oil circulating system of an internal combustion engine to dissipate heat. In other words, the extremes in surface temperatures to be encountered and the flow of oil which comes in contact with these surfaces must be considered along with the heat to be dissipated, he said.

Discussion from the floor agreed with Mr. Young's contention that oil deterioration troubles in certain designs and sizes of engines have been quite prevalent in the compression-type engine field. It was believed that complete freedom from this possible trouble may be had by properly spray-cooling the piston body rather than by extraction of heat through possible oil film on pistons or on cylinder walls then to the jacket water. It was also agreed that the cost of incorporating the oil cooler as a part of this typical type of engine and its oil cooler and internal cooling system as a part of the complete engine is well repaid by results obtained.

In his paper Mr. Young said that a study by the production departments of a major oil company on engine maintenance costs revealed that cooling and troubles relating thereto accounted for a considerable item of expense, with the result that this company not only changed over to closed cooling systems with special means of de-aerating the water while in rapid circulation from the jacket, but also carried the study into the field of internal oil cooling. Data compiled by the company from tests made on four engines showed a wide discrepancy but indicated the large amount of heat which may be taken out of the pistons. Three of the four engines tested were of the 2-cycle type. One had a bore and stroke of 10¼x14 in., one of 12½x15 in., and one of 12x14 in. The 4-cycle engine tested had a bore of 10¼ in. and a stroke of 13¼ in. Without circulation of oil into the pistons, at least a goodly portion of this heat would vaporize oil. The oil circulation rate on the 14x14-in. bore and stroke, 150 hp engine was the highest figure of 50 gpm.

Owing to the inability of engine builders, users of engines, and radiator manufacturers to coordinate efforts, progress made along the lines of correcting conditions in the oil temperature control field has been comparatively slow, Mr. Young explained.

"When we consider that the heat subtracted from oil for the large horsepower engines for satisfactory operation under maximum conditions is practically equal to the heat dissipation of an average automobile radiator, there becomes no question regarding the usefulness and necessity for an oil cooler, or, better, an oil temperature control unit. It is therefore standard equipment on practically all modern large engines, especially those of the compression-ignition type where greater compression ratios and heat loads are to be reckoned with," he continued.

In summarizing his paper, Mr. Young said: (1) Satisfactory methods of oil temperature control may be obtained either with air type or water type coolers, the type to be used depending upon requirements of temperatures to be maintained, the air type cooler being necessary if oil temperatures are desired below the water temperature: (2) Oil coolers must be selected large enough in capacity so that they will continuously furnish sufficient cooling regardless of the condition of the heat transfer surface; oil passages should be selected which are large enough so there will be no plugging or stoppage of oil flow: (3) Longer life can be given to certain parts, which at the present time become badly worn and have to be replaced, through the control of oil temperatures with equipment that may be developed and used. More certainty of operation and elimination of troubles that are now known to occur will also result: (4) To accomplish this end, cooperative efforts of metallurgists, engine manufacturer, lubrication engineer and manufacturer of heat transfer apparatus, is imperative.

The paper, "Some Factors Affecting Wear in Heavy-Duty Engines," by F. L. Miller and W. C. Winning, Standard Oil Development Co., brought out that the surface finish is an impor-

tant factor in cutting engine wear. Brief operating periods after starting engine was said to be a most important factor in increasing the wear of an engine. Another factor is fuel. This paper also emphasized the importance of dust and dirt as a factor in wear. While addition of agents to oil had a tendency to reduce wear it does not cut down friction. Reduction of friction, it was stressed does not necessarily go hand in hand with reduction of engine wear.

The controversy over value of "oiliness agents" added to lubricating oil might easily be settled, the paper pointed out, through a study of engines using both types of oil.

In emphasizing the importance of cleanliness of the ring zone, the paper stressed that any oil which will reduce sediments behind rings will aid in reduction of engine wear generally.

It was further pointed out that cleanliness of crankcase oil depends to a great extent upon the wear in the engine; and that oil consumption depends largely upon engine wear.

Walter G. Ainsley, Sinclair Refining Co., and D. P. Barnard, Standard Oil Co. of Indiana, who discussed the paper, agreed with many of the points it brought out, adding that oil had two functions, (1) heat transferring and (2) reduction of friction. Oil, Mr. Ainsley said, could be improved, through various methods of treating, bearing out contentions by Mr. Miller the previous day, that engine wear could be reduced by use of oils containing compounds. It was Mr. Ainsley's contention also that true engine wear information could be obtained only from examination and tests of engines that had been in actual use, and not from test engines in laboratories.

Low temperature operation of engines has more effect on engine wear than many of the other reasons brought forth during the two-day session, Dr. Barnard contended in his discussion of the paper.

The Friday afternoon session was concerned with discussions of developments in engine protection from these sources as a means of prolonging life and increasing efficiency of motive power.

In his discussion on "Developed Methods Recommended for Sealing Dirt, Grease and Oil," R. J. Vedovell, Chicago Rawhide Mfg. Co., pointed out that developments in the bearing field have made possible higher speeds, greater loads and increased efficiency, and have also necessitated a change in sealing methods to give bearings adequate protection.

"The urgent need for better sealing methods resulted in the development of the self-contained, press fitted, spring-loaded seal having a flexible non-shaft-scoring leather sealing member," he explained.

In his paper, Mr. Vedovell discussed the single seal; rear crankshaft seal; the felt and leather combination seal developed to help solve the problem of the farm implement and tractor industry; the engine front crankshaft seal, to aid the work of the air cleaner and other attachments for preventing the entrance of dirt; the pulley carrier seal with felt; Dual Type "C" seal; the tractor ditcher reverse gear transmission seal; Dual Type "A"; the external type seal, a development which he said had definitely solved the problem of front-wheel bearing wear on tractors; Type "G" Seal; double flange tandem oil seal; finger spring seal; and the self-contained diaphragm seal.

Discussion on this paper led to the explanation by a representative of the Victor Gasket & Mfg. Co., of the synthetic oil seal which eliminates the spring type construction of the oil seals discussed. This type seal, it was contended, is especially adaptable for use in places where a spring type seal would not be convenient because of limited space.

"Accelerated Wear Tests" was the subject of the paper by J. B. Fisher, Waukesha Motor Co. He showed slides of "dust house" tests conducted to test motors at Waukesha Motors. Motor wear, he said, can be caused by innumerable conditions, including corrosion – something which has not been given enough attention as yet. It was Mr. Fisher's contention that 90% of cylinder wear comes in starting the motor, and the 20 min of warm-up is equal to at least 30 hr of actual operating engine wear.

A technical discussion of standard laboratory test methods suggested by the air cleaner code subcommittees of the tractor section were given by W. H. Worthington, John Deere Tractor Co., in presenting the "Air Cleaner Test Code" to the meeting for consideration.

The proposed code, Mr. Worthington explained, is submitted as a laboratory procedure only and it must be recognized that when an air cleaner had been developed to a satisfactory point in the laboratory, the final verification of the application can result only from field determinations. The efforts of the committee were extended toward formulating a comprehensive test procedure which will fully develop the characteristics and possibilities of the air cleaner being tested and permit of doing this work in a convenient and commercial manner.

"Due to the absence of definite information and the almost unanimous lack of agreement on the part of those concerned, we have not found it possible to set up a standard test dust although it may well be stressed that there is probably no single element affecting to so great a degree the efficiency of an air cleaner as the fineness of the dust used in testing," Mr. Worthington explained.

Favorable comment on the proposed code was made by William Lother, Donaldson Co., who pointed out the difficulties now being encountered with installations of air cleaners because of the streamlining of tractors. One thing which has to be eliminated, he said, was the high stack so that the cleaner will fit into the general design of the tractor.

R. C. Darnell, King Seeley Corp., warned against over-designing of air cleaners. He explained that while there are several "severe" conditions in the proposed code, some of the demands from the consumer for so-called "over-designed" cleaners, are far worse.

Others who commented favorably on the code included John Beatty, and T. W. Hallerberg, of United Specialties Co.

Value of Proving Ground And Road Tests Compared

• Pittsburgh

Advantages of proving ground testing of cars over testing on public roads were brought out to members of the Pittsburgh Section on Sept. 26, by C. E. Farrell, manager, weight analysis and divisional contact department, General Motors Proving Ground at Milford, Mich.

Proving grounds, he said, are the result of evolution from the hazards of road testing of the early days of the industry. The increased safety was apparent when Mr. Farrell declared that at Milford more than 75,000,000 miles have been driven, most of it at high speed, with but one fatal accident.

He explained that the cars make the circuit of the Proving Ground track clockwise because in this way the slower cars can keep to the inside of the loop while the faster cars, keeping to the banked outside of the circuit, pass on the left, as they do on the highways.

Changing road surfaces eliminating, in many instances, ability to make definite comparison of progress from year to year, when the tests were made on public highways, is one of the difficulties overcome at the Proving Ground, where road surfaces are controlled, he said.

Among the interesting pieces of Proving Ground equipment described by Mr. Farrell, was a device designed to measure the volume of a combustion chamber within an accuracy of less than 1%. A whistle, he explained, is fitted into the spark-plug opening and its note compared with that of a similar whistle attached to a cylinder whose volume can be varied and easily measured. When the pitch of each is the same, the volume is equal.

After his talk, Mr. Farrell showed a sound moving picture, "The Parade of Progress," and answered questions about the General Motors Proving Ground.

Section Chairman R. M. Welker introduced the speaker after first calling on each of the 100 men present to introduce himself. The get-together dinner preceding the meeting was attended by 48 men.

SAE Council Indorses Proposed Standards

Proposed American Standards for Involute Splines and for Taps – Cut and Ground Threads, were approved by the SAE Council, subject to regular approval by the General Standards Committee. The Council also approved the revised American Standard on Round Unslotted Head Bolts, which already had been indorsed by the General Standards Committee.

Canadian Members Offer Services to Government

Soon after the Dominion of Canada issued its proclamation of war, members of the Canadian Section, in a letter to Prime Minister W. L. Mackenzie King, proffered to Canada and the Empire "loyal collaboration of a representative committee of automotive engineers and technicians in the solution of problems with which your administration's departments are and may be confronted, directly or indirectly, because of the war." Copies of this letter were sent to the chairmen of the Canadian War Supply Board, the Minister of Militia and Defense, and the Minister of Transport.

Cordial acknowledgments have been received from the Prime Minister and from Wallace R. Campbell, chairman of the War Supply Board, who indicated that his Board will avail itself of the volunteered cooperation.

Mr. Campbell, who has been an associate member of the Society since 1934, is president of the Ford Motor Co. of Canada, Ltd. He recently was appointed to his post of chairman of the War Supply Board, which has been organized to coordinate wartime manufacture of munitions and to supervise the purchase of munitions and other war supplies. It is empowered to act for the Canadian Government, and also for Great Britain, any of the Dominions, or allied powers, as well.

Three Canadian Section members have joined the Royal Canadian Army. Past-Section Chairman Max Evans is a major in the Tank Corps at Oshawa, Sarnia District Vice-Chairman, Major W. Eric Harris, has joined his unit, the 26th Battery, and C. W. Kirkpatrick is flight lieutenant with the Royal Canadian Air Force.

Fleet Cuts Costs $40,000 By Pooling Passenger Cars

• Tulsa Group

How the pooling of passenger cars in a public utility fleet cut transportation costs in the neighborhood of $40,000 per year, was one of the many points covered by H. R. Grigsby, superintendent of transportation, Oklahoma Gas & Electric Co., in his paper "Maintenance and Utilization of a Public Utility Fleet," presented before the Tulsa Group, Sept. 29. The data were based upon his company's fleet, which includes 134 passenger cars, 196 pick-up trucks, 69 trucks 1½ ton and up, and 48 pieces of miscellaneous equipment.

He reported that after operating a small pool of passenger cars for a number of years, a check-up showed that many of the non-pooled

SAE *Coming* EVENTS

Nov. 2-3 — **National Fuels & Lubricants Meeting**
Mayo Hotel – Tulsa, Okla.

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Jan. 15-19 — **Annual Meeting *and Engineering Display***
Book-Cadillac Hotel – Detroit

Baltimore – Nov. 3

Engineers Club; dinner 6:30 p.m. Lubrication – Dr. C. J. Livingstone, Mellon Institute of Industrial Research.

Buffalo – Nov. 14

Hotel Statler; dinner 6:30 p.m. Subject – Diesel Engines.

Chicago – Nov. 8

Morning session 10:00 a.m. at the Palmer House. Suggested Method for Load or Capacity Rating of Motor Trucks – Fred B. Lautzenhiser, transportation engineer, International Harvester Co.

Afternoon – visit to National Motor Truck Show and Chicago Automobile Show.

Dinner 6:30 p.m. Saddle and Sirloin Club, Stock Yards, with technical session following.

Cleveland – Nov. 13

Cleveland Club; dinner 6:30 p.m. The Future Field for Gasoline Engines – F. S. Baster, chief engineer, White Motor Co. The Future Field for Diesel Engines – C. L. Cummins, Cummins Engine Co.

Dayton – No Meeting

Detroit – Nov. 6 and 20

Nov. 6 – dinner 6:30 p.m. Hotel Statler. What's It All About? – H. Ledyard Towle, director of advertising and creative design, Pittsburgh Plate Glass Co.

Nov. 20 – meeting 8:00 p.m. Hotel Statler. Fuel Injection Engines – O. W. Schey, National Advisory Committee for Aeronautics.

Indiana – Nov. 9

Antlers Hotel, Indianapolis; dinner 6:30 p.m. Malleable and Steel Castings – Dr. Harry A. Schwartz, research manager, National Malleable and Steel Castings Co.

Kansas City – No Meeting

Metropolitan – Nov. 15

Hotel New Yorker; dinner 6:30 p.m. Automatic Flight – M. F. Bates, special project engineer, Sperry Gyroscope Co.

Milwaukee – Nov. 17

Antlers Hotel; dinner 6:30 p.m. Hydraulic Drives for Industrial Service – Robert M. Schaefer, manager hydraulic department, Twin Disc Clutch Co.

New England – Nov. 14

Engineers' Club, Boston, Mass.; dinner 6:30 p.m.

Northern California – Nov. 14

Hotel Leamington, Oakland; dinner 6:30 p.m. Oil Filters and Lubrication – John R. MacGregor, research engineer, Standard Oil Co. of Calif.

Philadelphia – Nov. 8

Penn Athletic Club; dinner 6:30 p.m. Why We Build Our Own Trucks – Ralph Werner, United Parcel Service.

Oregon – Nov. 10

Portland.

Pittsburgh – Nov. 21

Roosevelt Hotel; dinner 6:30 p.m.

Southern California – Nov. 10 and 17

Nov. 10 – Elks Temple, Los Angeles; dinner 6:30 p.m. Streamlining Fleet Maintenance – Ralph Faber and C. R. Stewart.

Nov. 17 – El Centro; dinner 6:30 p.m. Streamlining Fleet Maintenance – Ralph Faber and C. R. Stewart.

Southern New England – Nov. 1

Bond Hotel, Hartford; dinner 6:30 p.m. Trends in 1940 Car Design – T. A. Bissell, technical editor, SAE Journal.

Syracuse – Nov. 27

Onondaga Hotel; dinner 6:30 p.m. Analysis of the Engineering Design Features of the 1940 Cars – Joseph Geschelin, Detroit technical editor, Chilton Publications.

Washington – Nov. 14 and 28

Nov. 14 – Cosmos Club, Washington, D. C.; dinner 6:30 p.m. Instrument Landing – Col. S. F. Mashbir, Washington Institute of Technology.

Nov. 28 – P. E. P. Co. Auditorium. Joint meeting with American Welding Society. Welding of Aircraft Structures – H. V. Thaden, sales engineer, Carnegie Illinois Steel Corp.

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cars assigned to employees were not actually required full time, so that at the first of this year the scope of the pool was extended to include all passenger cars.

Now, he explained, only those employees who use a car each day, and particularly those who carry considerable equipment, have a regularly assigned car. These cars are turned in every night if they are in a town where there is a company garage. All other employees, regardless of position, use a car from the pool. When they require a car it is checked out and returned to the garage as soon as the trip is completed. Many of these cars are used by several individuals during a day.

"We estimated that this pooling of all passenger cars would reduce our transportation costs $25,000 per year," he stated, adding that "based upon our experience for the first 6 months, we will save easily $40,000 on this change."

The vehicles of the fleet, Mr. Grigsby revealed, are placed on a preventive maintenance schedule which calls for a short inspection at 2500-mile periods, covering items needing frequent inspection and a grease job, and for a complete inspection at 5000-mile periods. A file is carried on each vehicle which shows what work has been required during its life.

Touching on motor oil, Mr. Grigsby said that it is his company's policy to run motor oil until it starts to show discoloration on the gage stick, at which time both the oil and the filter cartridge are changed. A limit of 5000 miles has been set for running motor oil without change, but they prefer not to let it go over 4000 miles. He added that laboratory tests have convinced them that oil should not be run indefinitely regardless of how good it looks.

The Oklahoma G&E fleet, the speaker said, has vehicles in 56 towns. It maintains 8 service garages and 2 storage garages. They have found that a full-time service man is not justified unless at least 15 vehicles are quartered in one location. In districts where there are fewer vehicles, he explained, dealer service is depended upon, although it has not been found altogether satisfactory. He noted that they have had better success in contacts with filling stations which are relied upon for washing, greasing, and care of batteries, air cleaners, and tires.

Quoting statistics to show that public utility fleets differ from those in commercial service, Mr. Grigsby said that the passenger cars and pick-up trucks in his company's fleet average 1143 miles per month and get 14.2 mpg, with total operating costs (including overhead) of 4.75¢ per mile. Trucks, 1½ ton and up, average 664 miles per month, and get 6.91 mpg, with operating costs averaging 14.26¢ per mile. Service men, meter setters, and collectors, he reported, make 30 to 50 calls per day, and the trucks are virtually traveling work shops, carrying winches, pole derricks, and sometimes hole diggers.

This was a joint meeting of the Tulsa Group and the Petroleum Motor Transport Association. There were 41 present at the meeting which was held at the Hotel Mayo.

Schlink Tells "Kicks" Consumer Has on Cars

• Philadelphia

The American automobile industry has done a better job for the users of its products, in the opinion of consumers, than any other industry – and far better than the automobile industry of any other country, F. J. Schlink, technical director, Consumers Research, Inc., told a Philadelphia Section audience of 150 on Oct. 11.

This tribute from the author of "Your Money's Worth" and "One Hundred Million Guinea Pigs" was preliminary to frank and detailed statement of things which, in the opinion of Mr. Schlink and many of the consumers with whom he is in contact, the automobile builders have done wrong.

Mr. Schlink mourned the passing of the Model A Ford because of its ability to negotiate country roads where the center is grown high with vegetation or is badly crowned. He objected to the change from straight to slanting windshields and rear windows, branding the present type as unsafe under severe weather conditions. He pointed to the utter inadequacy of tools – particularly jacks – supplied with cars today and voiced serious consumer objection to windshield wipers incapable of wiping away moisture without leaving ridges of water to confuse vision. He objected to increasing car lengths, because of the greater parking difficul-

ties resulting and ridiculed locked glove compartments with bottoms made of cardboard.

Policies of the industry which the intelligent consumer frowns upon, as reported by Mr. Schlink, include: the confusion between advertised prices and local delivered prices; insistence on bringing out a new model every year; a tendency of manufacturers not to live up to their 90-day warranty to the fullest extent, and unwillingness of car engineers to tell consumers, even in answer to direct questions, what they know and think about various gadgets and accessories offered by different inventors and after-market companies.

Speed, in Mr. Schlink's opinion, unquestionably is responsible for a large proportion of the highway accidents and he blames manufacturers severely for encouraging speed through installation of 120 mph speedometers and other means.

Mr. Schlink also questioned the validity of manufacturers' recommendations about oil change periods and about the differences between various types of oil so far as average consumer operation is concerned.

Discussion brought out widespread disagreement with many of Mr. Schlink's contentions, considerable outline of the practical sales and design problems facing the manufacturer and a belief that in some respects Mr. Schlink's objections to current practice were thoroughly justified.

The growing importance of the consumer movement was emphasized, and its possible practical value to manufacturers who studied it instead of opposing it blindly was urged.

Faced with the fact that the success of car makers in selling automobiles is proof of their having met consumer needs quite adequately, Mr. Schlink countered with the argument that the same amount of advertising and sales effort devoted to selling a car better suited to consumer needs would popularize it just as the current designs are popularized.

Mr. Schlink inveighed heavily against the "tin lace" on modern bodies and the high repair costs they engender even for eliminating small dents, and flayed designers for ever-decreasing accessibility of parts which makes it almost impossible for the average owner to do even simple service jobs himself.

Answering the criticism that an organization like Consumers Research couldn't hope to spend enough money to test cars as thoroughly as is done by the great automobile corporations, Mr. Schlink said:

"I believe that a little bit of research with results actually made available to the consumer is worth more to the consumer than millions of dollars worth with the results kept from him. Consumers Research will be glad to go out of the business of testing as soon as the manufacturers begin to make available to the public, fully and accurately, the results of their proving ground investigations."

Norman G. Shidle, executive editor, SAE Journal, was chairman of the meeting which was opened by Philadelphia Section Chairman Henry Jennings.

S·A·E Student Branches — OREGON STATE COLLEGE

Data supplied by Britt M. Smith, 1937-1938 SAE Student Branch Chairman at Oregon State College

AT the head of navigation on the Willamette River, 85 miles south of Portland, is the city of Corvallis. Here is located the Oregon State College upon whose campus is the first SAE Student Branch to be established west of the Rockies.

Informally organized in 1934 and granted its charter by the National Society during the following year, this Student Branch immediately became prominent as one of the most active in the Society.

Its regular monthly meetings, its participation in the annual "Engineers Bust," and its joint undertakings with student groups of other engineering societies, soon won the Student Branch its important place among campus organizations. The group has a special SAE bulletin board where it posts not only announcements of its many activities, but also clippings regarding recent developments in the automotive industry.

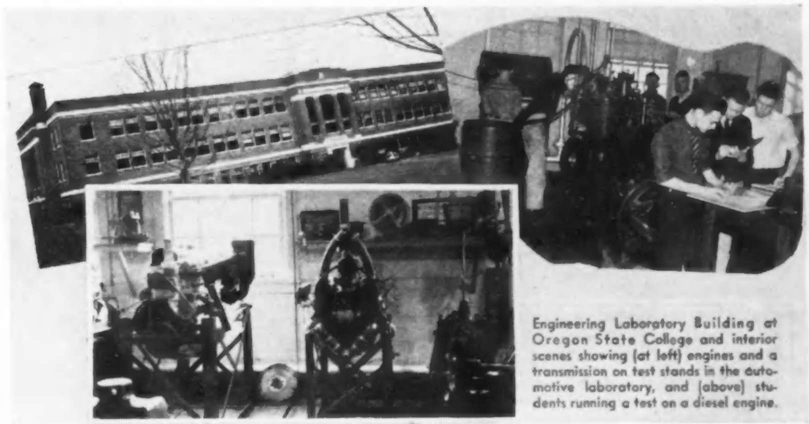
There has always been a close relationship between the Student Branch and the Oregon Section which fostered its organization. Despite the distance from Portland, it is not unusual for students to attend the Section meetings and for Section members to visit Corvallis. Joint meetings are held once a year.

The annual Student Prize Paper Contest, sponsored by the Oregon Section, creates great interest among members of the Branch, who have entered the majority of papers and have won all prizes in the contests since their inception in 1934-1935.

Last fall, when the four Pacific Coast Sections of the Society held their annual Transportation & Maintenance Meeting at Los Angeles, Student Branch Chairman Harold W. Ager, Jr., presented a paper on "What the Oregon State College is Doing to Help the Transportation Industry on the Pacific Coast."

In 1856, three years before Oregon was admitted into the Union as a state, a coeducational community school was organized in Corvallis. It was named Corvallis College and, after the Federal Land Grant Act of 1862 appropriated 90,000 acres to Oregon for educational purposes,

(*Concluded on page 27*)



Engineering Laboratory Building at Oregon State College and interior scenes showing (at left) engines and a transmission on test stands in the automotive laboratory, and (above) students running a test on a diesel engine.

130 See Construction of 2225-Hp Marine Diesels

• St. Louis

A preview of the trunk-type 2-cycle diesel marine engine being built by Busch-Sulzer for the United States Maritime Commission Class C-3 and C-1 vessels was granted 130 members and guests of the St. Louis Section at their first meeting of the year, held in the plant of the Busch-Sulzer Bros. Diesel Engine Co. on Oct. 4. The engines, which are in process of manufacture, were described by Leslie D. Calhoun, design engineer of the company.

He opened his talk by explaining that they are 7-cyl, 2225-hp, trunk-type, 2-cycle, direct reversible diesel engines, with a bore and stroke of 20½ in. by 27½ in. There will be four of these engines per ship, he explained, driving a single propeller through Westinghouse electromagnetic couplings and Falk gear reducers. The propeller will turn 85 rpm with the engines turning 240 rpm, and will have 9000 bhp with normal rating of the engines.

The speaker called attention to the wrist pin construction which permits a full bearing of the piston on the wrist pin over the entire upper surface of the pin, thus reducing bearing pressure at this point to half of its usual value. The wrist pin in this engine is lubricated from the piston-cooling oil rather than by a drilled connecting rod. Mr. Calhoun said that this method permits a reduction of oil-feed pressures to the main and crank bearings to the point where it becomes unnecessary to install splash

guards to keep the splash from the rod bearings throwing up into the cylinder.

These engines, said Mr. Calhoun, are constructed so that the upper cylinder liner is separated from the crankcase by a vented and illuminated chamber which permits the operator to observe the condition of the piston for three-fourths of its length, and which prevents blow-by from entering the crankcase. Below this chamber is a ring liner which, under normal load conditions, does not require any lubrication, but which is fed oil when the engine is running over rating, or when it is starting up.

In discussing the method by which the engine is reversed, the speaker asserted that complete reversal from full speed ahead to full speed astern requires only 6 sec, including the time required to cut off the fuel injection, allow the engine to stop, shift the injection camshaft so that the astern cams register with the followers, turning on the air to start astern rotation, and changing the valves on the rotary scavenging blower so that the direction of air flow will be into the engine regardless of direction of rotation of the blower impellers. All of these operations take place automatically, the only manual control being effected by a single reversing lever, he explained.

At the conclusion of the paper the audience was divided into small groups and conducted through the plant by guides. In the shops were seen machining operations on bedplates, cylinder liners, pistons, cylinder blocks, blowers and other components of the engine. Of particular interest was an engine on the test block which was being run at full load to determine its general performance characteristics, especially specific fuel consumption.

After everyone had had an opportunity to climb all over the engine and to see the various machining operations, the group reassembled in the original meeting hall for a discussion period and refreshments.

C. M. Beck of the Busch-Sulzer company welcomed the Section members, and turned the meeting over to their chairman, George R. Ericson, who introduced the speaker.

Bel Geddes Forecasts Magnetically Guided Cars

• Metropolitan

With a happy disregard for the "it-can't-be-done" school of thought, Norman Bel Geddes took more than 250 Metropolitan Section members and their guests on a whirlwind trip over the highways of the future. He spoke on Sept. 21, in the auditorium of the Brooklyn High School of Automotive Trades, following an inspection trip through the school and dinner in the school cafeteria. Board of Education officials, George F. Pigott, Jr., principal of the school, and members of his faculty were hosts.

If Mr. Bel Geddes has any hope that motorists will show marked improvement in driving within the next few decades, he was not exactly elated over such a prospect. Motor vehicles, he expects, will be equipped with such startling devices as magnetic controls to keep them in the proper lanes, and dashboards will have push-buttons and other controls which might well resemble organ consoles.

In general, he would crisscross superhighways from north to south, and from east to west across the continent. These would be fed by present highways, but the network of superhighways would consist of multi-lane straightaways reserved for traffic wanting to go 75 mph, and faster. His cross-overs would be wide sweeps permitting speeds of this order, and left turns could be made as readily as the right turns now in vogue on "cloverleaf" intersections.

These superhighways would miss all cities. Multi-deck bridges would carry the highways over rivers; tunnels would carry them through mountains. Signal systems, controls built into cars, buses, and trucks, and the highways themselves would take a good deal of the driver's responsibility away from him – which, according to Mr. Bel Geddes, would be all to the good, anyway.

A staff of engineers has been working out the details for several years, and the General Motors "Futurama" is a model of the development of the idea as of several years ago, he stated.

Early in his talk Mr. Bel Geddes pointed out that he is not a highway engineer, but only a layman. Whatever he calls himself, the audience agreed that he is a man of buoyant vision.

His dislike for traffic bottlenecks amounts to a passion. The economic waste of building wide highways only to close traffic in at bridges appalls him. He regrets that highway engineering is so far behind automotive engineering, and his studied solution will, he hopes, result in getting people from here to there in a hurry.

Furthermore, he will be a disappointed man if motor vehicles of the future can't keep up the pace his highways would set. He has great faith in automotive engineers and expects them to supply speed.

A. J. Schamehorn, director of General Motors Proving Ground at Milford, Mich., described the work being done there. He showed a number of instruments and other equipment built to test cars.

Engineering at best, he said, is not a very exact science, and only the Proving Ground method can be relied upon to disclose facts about an automobile or truck. More than 350 people are employed at the General Motors establishment, which covers 1268 acres. This work cost the corporation about 50 cents a car in 1928, but this figure will be about halved this year because of larger production of G. M. units.

Although apparently the test driving is hazardous, a total of 75,000,000 miles has been run over the various roads with but one fatal accident, because drivers are careful and obey the rules of the road, he reported.

In the absence of John F. Creamer, vice-chairman of the Section's student activity, Section Chairman T. L. Preble presided.

The high school is the most up-to-date institution of this type in the country. It is fully equipped with modern maintenance tools and equipment, and the students' work on a wide selection of chassis and engines of practically every standard make.

The school offers a four-year course in automotive maintenance, and a post-graduate course for boys who have had four years of high school. More than 2,700 boys are enrolled, and the staff numbers 114.

Instruction is given in general or academic subjects, technical courses, and actual shop work. Shop instruction includes work on engines, chassis, body repair, welding, painting, and testing after tune-up. A group of the students guided the visitors through the shop classrooms of the school.

SAE Horsepower Rating? There's No Such Thing!

STRANGE as it seems, even now there are references to "SAE" horsepower rating – despite the fact that it doesn't exist!

The formula $\frac{D^2N}{2.5}$, where D is the diameter of the cylinders in inches, N the number of cylinders, and the piston speed 1000 ft per min, wasn't sired by the SAE.

Developed for taxation purposes only, this convenient formula was originated by the Royal Automobile Club of England. It was first adopted in this country by the Association of Licensed Automobile Manufacturers, later the National Automobile Chamber of Commerce, and now the Automobile Manufacturers Association.

Back in the early days, when the SAE Handbook still was a loose-leaf publication, the formula was published for the convenience of SAE members – clearly credited to the RAC and the NACC. Because of the widespread use of the Handbook, and because engineers failed to note the credit line, it became falsely known as SAE horsepower rating – and despite efforts by the Society to refute parenthood for it, the term still is erroneously used.

These are the facts – there is no such thing as "SAE" horsepower rating, and there never was!

Students Get Data on 66,500-lb. Transport

• U. of Wisconsin

Expressing his belief that the youth of America definitely is aviation minded, Ray Kelly, superintendent of engineering research, United Air Lines, supported his contention by indicating the increasing percentage of graduate engineers choosing this field, in his talk before the Student Branch at the University of Wisconsin, last month. He told the students that the duties of research engineers in his department are to check all new airplanes and apparatus which might increase efficiency of planes. Each unit, he said, must pass many tests many times before it is adopted.

In the future, Mr. Kelly declared, we expect to see larger main-line planes, equipped for trans-continental service, which will make very few stops. Smaller planes on feeder lines, bearing cross-country passengers and mail from smaller cities, will make connections with coast-to-coast main-line planes at junction points.

He told of new planes weighing 66,500 lb, being constructed to replace the present 24,000-lb planes now being used on main lines. They will consume 200 gal of fuel per hour, have a ceiling of 24,000 ft, and will carry 52 passengers and sleep 30. The planes they replace consume 90 gal of fuel per hour, carry 21 passengers, and sleep 12. The new planes, he said, are equipped so that no matter how far above 8000 ft they fly, the air pressure of the plane never gets below that of 8000 ft.

Among the devices recently adopted by the air lines, which were explained by Mr. Kelly, was the new hydromatic propeller which makes it possible to stop an engine in 15 sec while a plane is in flight. This, he explained, eliminates vibration in case a motor fails. A new injection-type carburetor which injects the fuel into the air stream, he said, reduces fuel consumption about 10 gal per hr. He also told of the fuel-dump chute by which 100 gal of fuel may be dumped in an hour in case of emergency.

Some planes, Mr. Kelly stated, have been in service for more than 24,000,000 miles. They are kept in top condition, with an overhaul at 450 or 600 hr periods, and become obsolete before they are worn out, he explained. He sees need for better spark plugs and for better brakes.

John J. Hilt, vice-president of Young Radiator Co., was introduced, by Student Branch Chairman Kenneth Pike, as a representative of the Milwaukee Section, which is 100% behind the Wisconsin Student Branch. He pointed out the many benefits one receives from SAE membership.

Raising Octane Numbers May Not Cut Fuel Cost

• No. California

The economy in gasoline consumption for a motor vehicle going from 50 to 60 octane number, with compression ratio stepped up to match, is approximately 3 to 5% – and is about the same in changing from 60 to 70 or from 70 to 80 octane number fuel, R. M. Deanesly, chemical engineer, Shell Development Co., told members and guests attending the first fall meeting of the Northern California Section in Oakland, Sept. 12. He then pointed out that if the difference in fuel cost is 1¢ per gal, which is more than 5%, there is no gasoline cost saving in going to the higher octane number.

Economy in commercial air transportation shows a higher rate of gain, if expressed in the same units, because of distortion in the octane-number scale in the higher range, and because of the economy due to the replacement of fuel by an equivalent pay load, Mr. Deanesly stated. He emphasized, however, that in air transportation, too, the rate of rise in fuel cost per unit gained in octane rating is high, and that, at present price ratios, fuel of around 87 octane number is considered the most economical for an average flight.

Ten years ago, the speaker divulged, the manufacture of gasoline had reached a point where the characteristics of fuel necessary for present-day engines were understood by a few leading men in the industry, and both fuels and engines had been made, in an experimental way, which more or less realized today's levels. But, he noted, commercial and pleasure vehicles and airplanes in use at that time lagged far behind. Motor vehicles, he recalled, required only about 62 or 65 octane number fuel, and airplanes only 75 to 80 octane number. There was a general optimistic feeling that both the quantity and quality of gasoline could be improved, more or less indefinitely, mainly by erecting more cracking plants and using more lead, the speaker declared.

Effort to achieve higher octane number gasoline without the use of lead resulted in considerable research and improvement of cracking processes, the speaker suggested.

In discussing safety fuels, Mr. Deanesly pointed out that iso-paraffin of the right boiling range for safety fuel can be made, but that the process involves an extra step beyond what is needed to make technical octanes, and that, at present, we know of no other compounds which can be used for safety fuel unless the higher boiling aromatics become acceptable as a result of changes in engineering.

Summarizing the present fuel situation, Mr. Deanesly remarked that:

(1) The possibility of finding a better dope than tetraethyl lead is very remote.

(2) There are many pure hydrocarbons having octane ratings between 65 and 80, and there is, therefore, no technical difficulty in supplying gasoline of around 70 or a little higher octane number in large quantities. At this level the refiners' problem is merely to make it cheap, well-refined, and of good storage stability and low gum content.

(3) Above 80 octane number the possible hydrocarbon ingredients are very few and the technical problem of how to supply any such gasoline in quantity becomes very narrow and difficult.

(4) We know of several alcohols, ketones, and ethers which are roughly the equal of iso-octane in octane rating, but they have the disadvantage of lower calorific value, as well as water solubility and other mechanical difficulties which might be overcome. The synthesis of these materials in large quantities is an operation about as intricate, and therefore as costly, as of iso-octane.

In answer to questions at the completion of his paper, Mr. Deanesly said that perhaps aviation fuel, without lead, is better than motor fuel with lead, but that the supply would be limited or higher priced. When asked about the possibilities of very high cetane number diesel fuels, he stated that there is a tendency to assume that 100 cetane number would be as wonderful as 100 octane number gasoline. He believes, however, that the gain is not all of the same sort, pointing out that in any case compounds which have a very high cetane number tend to be similar to cetane. Mr. Deanesly stated that 60 cetane number seems to be about the upper limit of practical requirements. He also mentioned that while dopes for raising cetane numbers are very possible, the ones we now have must be used in relatively large quantities and are relatively costly.

Mr. Deanesly was introduced by W. V. Hanley, research engineer, Standard Oil Co. of Calif., who substituted for Fuels and Lubricants Vice-Chairman J. R. MacGregor as technical chairman of the meeting, which was opened by U. A. Patchett, chairman of the Section.

Oregon State College

(Concluded from page 25)

the school was "designated and adopted" as the State's agricultural college in 1868.

The first instruction in engineering was offered in 1888, or thereabouts, in connection with the department of mathematics. The department of engineering was the first of its kind in the Pacific Northwest. By 1900 definite establishment had been made, and by 1908 it had developed into a full degree-granting school. The university is now officially designated as the Oregon State Agricultural College, and has an enrolment in excess of 4000 students, with nearly 800 in the school of engineering.

The college's internal-combustion engine laboratory is well equipped with gas, gasoline, diesel, semi-diesel, and oil engines, as well as with facilities for complete tests of these engines for economy and efficiency. The aeronautical laboratory includes a selection of modern aircraft engines, a complete airplane of the Navy fighter type, as well as numerous wing panels, tail surfaces, instruments, and airplane parts. A small water channel for the study of fluid flow also is available.

In 1927 the Oregon State Engineering Experiment Station was established and a number of technical articles pertinent to the automotive industry have had their origin in the work of this station. Among the authors of these articles is W. H. Paul, assistant professor of mechanical engineering. Mr. Paul is an SAE member and faculty advisor for the Student Branch. Another SAE member on the engineering staff is R. N. Lunde, assistant professor of agricultural engineering.

Student Branch members graduated from the College are employed by such companies as Pratt & Whitney Aircraft, Union Oil Co. of Calif., Allis-Chalmers, and Standard Oil Co. of Calif., and on engineering faculties of several universities.

Field Editors

Baltimore – R. C. Hall
Buffalo – C. W. Georgi
Canadian – Warren B. Hastings
Chicago – Austin W. Stromberg
Cleveland – J. W. Morrison
Dayton – R. H. Henry
Detroit – William F. Sherman
Indiana – Harlow Hyde
Kansas City – L. P. Mecklenburg
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New England – J. T. Sullivan
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Northwest – R. J. Hutchinson
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Pittsburgh – Murray Fahnestock
St. Louis – A. R. Burgess
So. California – C. T. Austin
So. New England – L. F. Campbell
Syracuse – L. W. Moulton
Washington – George A. Barker

Get-Together Golf and Dinner Precede Meeting

• Canadian

When the Canadian Section held its first meeting of the new season, Sept. 21, Dr. H. R. Wolfe, General Motors Research Laboratories, was the guest-of-honor speaker, taking as his subject "Automotive Research."

The meeting was preceded by an afternoon of golf at the Hamilton Golf and Country Club, Ancaster, Ont., and a dinner at which Leeland Merrill, automotive division, International Harvester Co. of Canada, presented a travesty on serious golf primers.

Golf prizes were donated by the Firestone Tire & Rubber Co. of Canada, Ltd. Martin Buckingham, treasurer of the Section and general manager of Wallace Barnes Co., Ltd., was host to the gathering.

It was announced at this meeting that A. Frank Oliver, general sales manager, Electric Auto-Lite, Ltd., Sarnia, Ont., was elected successor to his confrere, Major W. Eric Harris, as regional vice-chairman of the Section for the Sarnia District. Major Harris resigned this post and that of membership committee chairman when his unit, the 26th Battery, R.C.A., was mobilized for active duty. Charles E. Tilston, immediate past-chairman of the Section, succeeds Major Harris as chairman of the membership committee.

Roper Demonstrates Sealed Beam Lighting

• Cleveland

The cooperative effort of car manufacturers, lamp manufacturers, safety authorities, and the motor vehicle administrators, which resulted in a single system of headlighting known as the "Sealed Beam System" was commended by Val J. Roper, automotive and aircraft lighting engineer, General Electric Co., in his talk before the Cleveland Section, at Nela Park, Oct. 9.

A laboratory demonstration was conducted by Mr. Roper, who showed how the traffic beam and the country beam are produced and explained the lens, reflector, and filament design. On the laboratory roadway, which is 75 ft long and includes a painted scene at the end which provides an illusion of an additional 500 ft, sealed beam lighting was compared with previous types of headlamps in both new and average condition.

Mr. Roper emphasized the excellent candlepower-maintenance feature of the sealed beam

lamps "which give 50% more light initially and maintain their initial output with very little depreciation throughout their life." These units, he stated, should last two years on the average car. They are designed for 50% longer life than previous headlamp bulbs.

The advantage of using the traffic beam when approaching other cars and when driving on lighted city streets was stressed by Mr. Roper. Data obtained in actual road tests using an observer-driver were presented, which proved greater visibility distance with the traffic beam than the mere geometric range of the beam pattern. Objects between two approaching cars can be seen in silhouette against the road lighted by the headlamps of the approaching car, he explained.

In closing, Mr. Roper expressed the need for proper aiming of headlamp beams and proper usage. "The integral sealed beam unit and the standard mounting, adjustment mechanisms, electrical systems, switching, and beam indicator which together comprise the complete sealed beam headlighting system used on most 1940 models, is a remarkable engineering and co-operative achievement and was made possible with the active assistance of the state motor vehicle administrators," he said, adding that the cooperation of car drivers is needed to insure the greater safety and comfort possible with sealed beam lighting. It is hoped, he declared, that every driver can learn and obey the jingle "Use traffic beam always when cars are near, use country beam only when road is clear," – to which might be added the phrase "And check headlamp aim device each year."

Aircraft Production of Leading Nations Compared

● No. California

Looking at the European aircraft production picture, T. P. Wright, director of engineering, Curtiss-Wright Corp., who has made several trips abroad in the past few years, estimated before the Northern California Section meeting of Oct. 10, that Germany seems easily capable of producing 10,000 to 12,000 planes per year; that England, although behind until recently, is just now attaining the above German figure; and that France, while not in the undesirable position earlier held by England, still has much to do in the direction of increased volume.

In the United States, he said, the needs of the Army Air Corps, the Navy, the export market, and our transport industry will call for the production of some 10,000 airplanes within the next two years. To make this possible, the military services have cut much red tape, no longer requiring prototypes and trial building of a small number of planes for extended service testing. To illustrate the relation of the increased business to that prevailing formerly, Mr. Wright remarked that if 1938 volume was considered to be 100 units, the volume in the preceding five years was 50 units, and for the next two years it would be 282 units. Contrary to the belief of many people, the increase from 100 to 282 can be cared for without much expansion of floor space within the aircraft industry, he declared. The military services are planning placement of their orders to avoid the mushroom growth of factories which, when the orders now anticipated are completed, would become vacant structures. By placing orders judiciously and by the use of several shifts of workmen in a factory, the aircraft industry hopes to avoid the sad experiences of many industries during the former war boom times, Mr. Wright stated.

Comparing aircraft production methods in this country and in Europe Mr. Wright revealed that considerably different methods are used on the two continents.

One fundamentally American practice, borrowed from the shipyards, is the use of the mold loft where wings and other large parts are laid out to full scale and manufacturing patterns prepared. This, Mr. Wright said, is largely responsible for many of the manufacturing economies which prevail in this country. Another American idea is the complete assemblage and testing of major independent units or systems, said Mr. Wright, who cited as an example the hydraulic system of the modern American airplane which is completely shop assembled and tested prior to being considered a finished design, and installed in an actual airplane. Engines, engine mountings, and cowlings, he said, are among other units tested independently and in advance, so that it is not necessary to experiment with them after they have been assembled in the completed airplane.

Mr. Wright pointed out that in an industry where the weight of the final product is so vital, efficiency must come as the result of a fine balance between materials, manufacturing methods, and final performance. From the design standpoint, he said, stress analysis is of major importance to permit full use to be made of the strength of all component parts of the finished airplane. The project engineer, Mr. Wright declared, holds a most important job in coordinating the activities of the various departments. He likewise remarked that it is considered that 1 mph increase in speed is worth $2500, and one pound decrease in weight $75 over the useful life of the plane, and thus it is obvious that the designer must work with extreme diligence in the improvement of minor details.

Touching on the layout and planning of the factory itself, Mr. Wright emphasized the

necessity of proper coordination of the many departments, so that the production line will run smoothly and so that there will be a pushing of all departments behind that doing final assembly, rather than having the final assembly department pulling on preceding departments for adequate materials and parts.

Following the conclusion of Mr. Wright's remarks, questions from the floor started when G. M. Smith of Pan-American Airways inquired regarding diesel aircraft engines in Germany. Mr. Wright replied that in 1936, diesels in Germany appeared to be on a par with gasoline engines. From a military standpoint, diesels in Germany now appear to be less popular than they were in 1936, by reason of advances in direct fuel injection and liquid cooling on spark-ignition engines.

S. B. Shaw, Pacific Gas & Electric Co., inquired regarding the use of magnesium alloys, to which Mr. Wright replied that he considers this country to be far behind Europe in the use of magnesium. While we make some use of magnesium castings, no magnesium sheets are used here. In France magnesium landing-gear castings are in use and magnesium propeller blades are found in both England and Germany.

Mr. Loomis of Standard Oil Co. of California, questioned Mr. Wright regarding the labor aspect of expanding our aircraft industry from the present 100 to the proposed 282 units and indicated that he could not see how we would avoid a big idle labor problem at the end of that time. Mr. Wright stated that the industry is hopeful that production will not fall back to the present 100 units but would remain at a level of 181 units by reason of expanded transport activities and export demands.

When questioned on liquid-cooled in-line engines versus air-cooled radial engines, Mr. Wright said that as far as the former are concerned we are far behind Europe. At least half of the German military engines are liquid-cooled, in-line type and the English Rolls Royce engine is a very efficient unit of this design. It is significant, said Mr. Wright, that the Air Corps has specified liquid-cooled in-line engines on all of its new pursuit planes. Mr. Wright said that for speeds under 300 mph, air resistance of the two engines would probably penalize the radial by 5 mph whereas for the higher speed military pursuit planes of today, disadvantage would probably be in the magnitude of 25 to 30 mph. Considering this, along with the easier maintenance and less weight of air-cooled engines, Mr. Wright felt they would probably hold their own in bomber and transport service.

Shows Time Saved by Induction Hardening

• So. New England

Great saving of time in hardening production parts was stressed by W. E. Benninghoff, Tocco Division, Ohio Crankshaft Co., in his address, "Differential Hardening the Induction Method," presented before some 200 members and guests at the joint meeting of the SAE Southern New England Section and the Hartford Chapter, American Society for Metals.

He cited cases of rocker shafts hardened in six spots per shaft at the rate of 1500 an hour, making 9000 spots hardened per hour. At the other extreme, a run of 150 pieces a day had been handled with a saving by the induction hardening method.

The need for reducing wear of metals, he stated, has led to a research for new materials and manufacturing techniques. One answer to the wear question has been the local hardening of surfaces of crank pins, axle shaft bearing surfaces, oil seal assemblies, built-up tappets, rocker-arm tips, and rocker shafts. Induction hardening has provided a hardening technique which is fast enough for production at low cost.

With the aid of many blackboard diagrams, Mr. Benninghoff showed how high-frequency induction produces a surface heating which can be accurately controlled. By a balance of the various factors of frequency of current, power input, and time applied, together with a delay before quenching if needed, the whole hardening cycle can be made automatic for a given part, so that all the operator has to do is load the machine and push the button. In fact, he says one of the best operators is a former baker, although this is not so strange as this is just another form of heat-treating.

The range of frequencies used, varies from 2000 cycles per sec to 250,000. On large parts, where 500 to 700 per hr are hardened, a motor generator set is used to give from 2000 to 5000 cycles per sec. On small parts with lower production runs, a spark-gap converter furnishes 200,000 to 250,000 cycles per sec. The power input being around 500 to 600 watts.

Most of the pieces hardened by the induction method are of circular or nearly circular section, and are held between the two halves of a split circular coil block, the speaker explained. High-frequency electric current is passed through this block, producing eddy currents and a "skin effect" which causes the surface to heat to the correct temperature for quenching, to harden the spot or surface under the blocks. Quenching, he said, is accomplished by water sprayed through holes in the coil blocks, so that it is not necessary to remove the piece from the block until finished. The whole hardening cycle is completed on crankshaft bearing surfaces in 4 to 6 sec per crankpin, he declared. The short time at high temperature reduces the danger of decar-

burization of the surface and distortion is reduced to a minimum. The time that the current is applied is controlled with the close accuracy of five one-hundredths of a second. In some parts one tenth of a second may be critical, he explained.

A hardened case with a hardness of 60 Rockwell "C" scale may be produced which holds this hardness to 80% of a depth of case of ⅛ in. This hard case blends into the softer 20%, and that layer blends well into the core, Mr. Benninghoff revealed.

Slides were shown of the many parts now hardened in production by the induction method, along with many microphotographs of the various case structures produced.

Mr. Benninghoff cautioned that forgings should be heat-treated before hardening, and not hardened in the as-forged condition.

Discussion after the address showed very active interest and brought out the fact that experiments were being made with hardening cutting tools of high-speed steel by the induction hardening method.

Reveals Data on Dynamic Fatigue Life of Rubber

● Detroit

Rubber has greatest resistance to dynamic fatigue when it is worked very hard – in fact, dynamic fatigue life is increased remarkably if the material is put under considerable load before any working forces are imposed at all. This, and other rather startling information pertinent to the mechanical uses of rubber, formed the subject of lively discussion at the Oct. 2 meeting of the Detroit Section, addressed by Dr. S. M. Cadwell of the United States Rubber Co.

In so far as is known, this meeting of the Detroit Section marks the first public revelation of important quantitative test data which form the entire basis for the application of rubber as a working part of mechanical devices. As a result, the meeting precipitated a veritable flood of discussion on the part of automotive engineers who were present and brought the expressed hope by L. A. Chaminade, Chevrolet Motor Division of General Motors Corp., that SAE standards and specifications would soon be available to cover the subject of rubber in its automotive applications.

Dr. Cadwell's paper, which was the result of joint effort by himself and R. A. Merrill, C. M. Sloman, and F. L. Yost, all of the United States Rubber Co., Detroit, is to be published in a subsequent issue of the Journal. Their investigations were based upon knowledge that "if a rubber member is continuously vibrated it will sooner or later crack and ultimately rupture due to the repeated oscillations to which it has been subjected. . . . The number of such repeated vibrations is the dynamic fatigue life."

Investigations covered dynamic fatigue life of rubber vibrated linearly between constant strain limits and under constant load conditions and also included investigations of shear strain. Types of testing equipment and samples were explained by Dr. Cadwell, and were shown in projection-slide illustrations.

The general nature of the dynamic fatigue life curve for small oscillation strokes is that "the minimum life is bounded in bolt compression and extension by regions of greater fatigue life," Dr. Cadwell stated. Moreover, he said, the test data demonstrate that the rubber exhibits a minimum dynamic fatigue life in the regions where the return stroke on the oscillation brings the sample back to a condition of zero strain. This is the basis for the assertion that hard working of the material improves its fatigue life.

Regarding this point, Dr. Cadwell mentioned that published articles previously have asserted "that the mechanical fatigue resistance of rubber is less in extension when the minimum of the oscillation falls near zero strain. However, no complete study has been published in which the fatigue lives of rubber have been completely investigated throughout the compression-extension region as a function of the strain or stress limits."

These conclusions were supported by all of the tests, including those under constant load conditions and under shear loads. This led Dr. Cadwell to the drawing of conclusions which simplified the whole outlook – which later brought repercussions in discussion from the floor of the meeting. In particular, A. S. Krotz, development engineer in the new products department of the Mechanical Division of the B. F. Goodrich Co., asserted that the method of testing shear samples introduced a complexity which could not be overlooked without risk of error.

However, there was no dissension from Dr. Cadwell's general conclusions which follow:

If rubber samples are compressed or extended a definite amount before oscillations are imposed, dynamic fatigue life is increased. In graphical form he showed results of tests on some 450 samples, 50 Durometer stock, demonstrating results for a series of constant oscillation strokes varying from 25% to 350% of the length of the sample.

For the 25% oscillation, as an example, the fatigue life at the minimum is about 6,000,000 cycles while at the maximum in the extension range, it is over 600,000,000 cycles, or more than 100 times as great.

Shear samples were similarly affected, Dr. Cadwell stated. Thus, for a sample which had no lateral strain, life was a minimum (1,000,000 cycles) when the sample was oscillated from the zero position to 50% of its original length, and was a maximum of 40,000,000 cycles when the material first was extended 25% over its original length, then underwent shearing forces which (referred to length) were 75% to 125% in a plus direction from the datum line.

Following Mr. Krotz's objection to "taking short cuts in coordinating shear and extension," Roy Brown, research engineer, Firestone Rubber Co., made the statement that his view of Dr. Cadwell's work is that its simplicity was of great merit. He advocated that the automotive engineers making use of Dr. Cadwell's data should stick to fundamentals rather than complicating Dr. Cadwell's simplified data in making the application. W. W. Vogt, Goodyear Rubber Co., pointed out that "it is going to be rather difficult to apply the 200 or 300% minimum strain followed by an elongation." He declared that while this may, in fact does, give the best resistance to fatigue by flexing, "sometimes it gets up into conditions of drift, or creep, or sagging which make the practical application a little more difficult."

K. D. Smith, B. F. Goodrich Co., stressed the possible application of newly revealed data in connection with pneumatic tires.

"In a body of a tire," Mr. Smith said, "the cord and rubber introduce a potent source of irregularity. Stresses in rubber are not uniform. It is not difficult to see, therefore, that a tension applied in one direction may check some of the potential fatigue, but actually accelerates failure in other portions, with a net result of quicker failure in a tire." This, he showed, is particularly a problem with white sidewall tires which frequently show no signs of checking or cracking next to the rim, while at the rim flange, or a half inch above the rim flange, serious cracking or checking occur.

Harry Woolson, executive engineer, Chrysler Corp., and active in attempts toward rubber standardization, complimented Dr. Cadwell on his presentation of the new material.

Others who offered comments or asked questions were W. J. McCortney, Chrysler Corp.; Dan Bradley, Harris Products Co.; Verne Jackson, Chevrolet; and R. B. Sneed, Ethyl Gasoline Corp.

The "Supercharger" published monthly by the Detroit Section appears this season with a new cover design which bears an outline drawing of a blower. Last year the "Supercharger" had on its cover the picture of a charging war horse bearing a knight in suit of armor.

Cooperate on Screw Threads

The Society of Automotive Engineers and the American Society of Mechanical Engineers, cosponsors of sectional committees on screw thread products and threading tools, and the American Standards Association, are in every way possible cooperating with the recently formed committee of the United States Department of Commerce, the Army, and the Navy, which plans to coordinate screw-thread standards of the various Governmental departments.

Byrne Cracks Par to Win Golf Tournament

● Chicago

Scoring a neat 70, one under par, John Byrne of Mack came in ahead of a field of 40 competing in the Chicago Section's golf tournament at Westward-Ho Country Club on Sept. 15. With the exception of one other special prize, all other awards were based on the "Peoria System" – the allotting of handicaps based upon scores made on blind holes.

Leo Huff of the Pure Oil Co., under protest, was awarded the special prize for having the highest gross, the highest net, and for being the most honest golfer.

Dye Research Helps Solve Metal-Cleaning Problem

● Northwest

How chemists, with their eyes on the dye and fabric industry, developed emulsifiers and wetting agents which are revolutionizing the metal-cleaning methods used by the automotive and aircraft industries, was depicted by Valentine Gephart, president of the Valentine Co., at the Sept. 15 meeting of the Northwest Section.

The chemists' original problem, he said, was to develop emulsifiers or surface-tension-reducing agents to meet the demand for more complete penetration of dyes in fabrics.

"For some time," declared Mr. Gephart, "these interesting surface-tension-reducing chemicals were more laboratory curiosities than available raw materials for the manufacturer of cleaning compounds and soaps. Late in 1936 there appeared on the market a very excellent product with a nasty smell. This product was offered to the automotive industry as a degreaser and cleaner for metal parts. It consisted of a solvent soap base made from the saponification of cresylic acid with the hydroxide of either sodium or potassium. Such a solvent soap containing an organic solvent, such as benzine, carbon tetrachloride or ethylene dichloride, could be used as an emulsifier of grease on metal surfaces in a manner to render the grease on such a surface water-soluble."

This, he said, was one of the first steps toward modern emulsion cleaning, and stimulated research in laboratories of several cleaning material manufacturers. It brought up this thought, he said, "If the automotive industry, and more important, the 'aeromotive' industry, could secure a chemical that was within the price range of soaps or solvents, and one that had a hydrogen ion concentration near that of the metals used in aircraft production, which chemical would render grease water-soluble, then one of the most dangerous operations of aircraft maintenance would be made safe. The danger I mention," he continued, "is that of alkaline corrosion of aluminum and its alloys. All of the alkaline cleaners that are rapidly water-soluble will attack aluminum when used in sufficient concentrations to effectively saponify the grease and remove it with the available hot or cold water sprays of the average shops or maintenance depots."

Mr. Gephart explained that many inhibitors have been tried to reduce the corrosive action of the alkaline cleaner on aluminum, but, with the exception of the silicates, there has been very little success. In the case of the silicates, he noted, the sodium tri-silicate has been the most successful.

The new developments in the category of synthetic soap substitutes, wetting and emulsifying agents are now available in many finished products of reliable manufacturers, Mr. Gephart declared. He stated that they contain one or more of the many new solvents produced by introducing hydroxyl and similar radicals into olefinic hydrocarbons and combining, condensing, or polymerizing these into a very wide variety of new solvents, such as ethers, esters, and cyclo compounds, which have unusual and remarkable solvent properties, and in many cases have the property of being both oil and water miscible.

This latter property, he said, has made these compounds a most valuable tool to the manufacturers of degreasing chemicals.

Mr. Gephart then reviewed the different types of new cleaning compounds and showed just what benefits modern research has given the automotive engineer in furnishing correct chemicals for every job.

Members of the Section were surprised when Mr. Gephart displayed a duckling swimming happily in a bowl of water – but the duckling was more surprised a moment later when he found he couldn't swim. Mr. Gephart had added an emulsifier to the water breaking the surface tension.

Weick Presents Paper on Wood-Plastic Propellers

● Washington

Fred E. Weick, chief engineer, Engineering & Research Corp., and a past vice-president of the SAE, was guest-of-honor speaker at the Washington Section's opening meeting, Oct. 10; presenting his paper, "Composite Wood and Plastic Propeller Blades," which was published in the Transactions Section of the SAE Journal for June, 1939. He referred to this type of blade as the answer to the propeller problem on the latest high-horsepower output engine, where propeller weight is of vital importance.

SAE Papers in Digest

HERE are digests of papers presented at various meetings of the Society.

Some of these papers will be printed in full in the SAE JOURNAL.

Mimeographed copies of *all papers received* will be available, until current supplies are exhausted, at a cost of 25 cents per copy to members; and at 50 cents per copy to non-members, plus 2% sales tax on those delivered in New York City. Orders for mimeographed copies must be accompanied by remittance and should be addressed to Sessions Secretary, Society of Automotive Engineers, 29 West 39th St., New York.

West Coast Transportation and Maintenance Meeting, Los Angeles, Calif. Nov. 3-5, 1938

The West's Contribution to Low Cost Motor Operation – *Watt L. Moreland, Moreland Motor Truck Co.*

MR. MORELAND points out the differences in operating conditions between the East and the West to show why it was necessary to make such radical changes in the construction of motor vehicles to meet the requirements of Western highway transportation. These differences are named as the much smaller proportion of railroad mileage to the total area, the much greater distances between population centers, high mountains, and hot deserts. Consequently the services required of motor vehicles in these Western States have always overtaxed the vehicle, and always the demand has been for more reliable, stronger, better, larger, faster, and safer motor vehicles. Consequently, today no vehicle manufacturer would think of putting on the market a new motor vehicle unless it first had been tested and tried thoroughly under the severe operating conditions of the Western States, knowing that successful operation under these conditions insures successful operation anywhere in the world.

Among the notable motor-vehicle improvements contributed by California and the Western States mentioned by the author are the first high-speed, high-compression motor; the first copper-lead bearings; the first successful engine to use distillate for fuel; the first multiple-speed transmissions; air brakes suitable for motor vehicles; the hydraulic brake; multiple and dual axles; and the first modern drop-frame, low-center-of-gravity safety passenger bus.

The abundant supply of motor fuel in the Western States is believed to be their greatest contribution to low-cost highway transportation.

What Oregon State College Is Doing that Is Important to Pacific Coast Motor-Vehicle Operators – *Harold Ager, Oregon State College.*

LIMITING his discussion to what Oregon State has to offer the operator in engineering, Mr. Ager first reviews the mechanical-engineering curriculum as offered in the School of Engineering. In the last two years of the four-year course, he recommends that the automotive engineering specialty should be selected. This course was planned specifically to prepare men for the automotive industry on the Pacific Coast and, therefore, it touches only lightly on design problems. Fuels and lubricants, power-plant testing, automotive body and chassis engineering, transmissions, clutches, brakes, steering gears, fleet operation, maintenance, economics, and road-testing are among the subjects studied in classroom and laboratory.

In the remainder of the paper laboratory facilities and equipment are detailed, the work in the Oregon State Engineering Experiment Station is described, the development of the Oregon State SAE Student Branch is traced, and the record of placement of graduates in the automotive industry is reviewed.

Reducing Costs – *C. G. Anthony, Pacific Freight Lines.*

HOW his company, the Pacific Freight Lines, reduced its maintenance costs until they were "among the lowest in the United States," is outlined by the author in this paper. Maintenance costs of this company, which operates more than 600 pieces of equipment hauling general merchandise over regular routes, make up 11% of the total operating costs, he reveals.

Every evening, when each piece of equipment is returned to the terminal, the operator makes a detailed report on a standard form, which contains 32 different items on which the driver must report as OK, or whether any need inspection or repair. This work is done immediately in time to report the equipment for use the next day. In addition, a series of inspections for preventive maintenance is carried on regularly.

Depending upon type of service and size, certain groups of trucks are inspected every 60 days; others, every 90 days; and a few are inspected at 120-day periods – in order to discover wearing parts and effect repair or replacement before failure.

Although general overhauls are kept away from as much as possible, when their necessity arises, the inspector's estimate must be approved by a company officer. Discussing the influence of the type of the driver, Mr. Anthony explains that a complete report is made in duplicate of all road failures, one copy going to the personnel department where it becomes a part of the record of the driver involved.

Maintenance group expenses are expressed as a percentage of gross revenue. This percentage is known as the operating ratio for the particular expense group, and is compared with that of the preceding month, the same month last year, and so on, thus giving a basis for accounting control. This same ratio of expense to gross revenue also is used to control transportation, traffic, insurance and safety, and general administrative expenses.

Maintenance of Army and CCC Motor Transportation in the Ninth Corps Area – *Lt.-Col. E. C. McGuire, U. S. Army.*

THE system of motor maintenance for Regular Army vehicles and those assigned to the Army for Civil Conservation Corps work is outlined. It is shown that the work is divided into definite steps and assigned to personnel and equipment suitable only for these various steps in maintenance.

Inspection, discipline, and control are mentioned as essential items and, in the case of Regular Army vehicles, at no time must immobility be allowed to creep in and destroy the ability of troops to move, and of the maintenance agencies to follow up and assist in the work upon which they may be engaged. The author stresses that this problem is one of mounting importance as the Army is developing today as it is not hard to see that the motor transportation of modern troops will be vital to any success which they might achieve. A fall-down in motor maintenance might result in disaster, and the problem is one which must be studied constantly and efforts made to train more and more personnel.

In conclusion it is suggested that, in the initial stages of mobilization for war, commercial transportation equipment may be rented to the Army, and many of the personnel now employed in commercial transportation will be essential to assist in carrying on the work.

Cost Control in City Bus Operation – *C. B. Lindsey, Los Angeles Railway Co.*

TO control the cost of operating and maintaining a fleet of 267 motor coaches, 57 trucks, and 45 automobiles, the Los Angeles Railway Corp. established a definite system of record keeping whereby it is known immediately when certain units are exceeding their normal cost per mile. Beside checking the cost per mile of any of the Corporation's 24 types of coaches, the cost per mile of the seven major units which go to make up a motor coach – body, brakes, engine, and so on – can be determined. This breakdown indicates the source of increased costs. A cost comparison is issued quarterly and checked carefully.

The maintenance cost exclusive of tires is from 15 to 19% of the total cost per mile of operation, and the fuel cost per mile averages from 11 to 13% of the total operating cost, not including handling charges. However, the need for rapid acceleration, due to modern traffic requirements, has resulted in less miles per gallon than ever and, in this operation, the increasing weight of later-model coaches has not helped the situation.

This paper also describes the system used for keeping down fuel consumption, including the method of testing so-called fuel-saving appliances, tests on coaches operating on butane or rock gas, and the Richfield test for "gassing." Conclusions from the last test indicate that engine design is the major factor affecting "gassing"; that the mechanical condition and adjustment have a secondary but profound effect; and that the trouble can be reduced materially by mechanical "degassing" devices.

Overhead – *S. B. Shaw, Pacific Gas & Electric Co.*

THIS paper reviews the principal elements of overhead which contribute to the total cost of operating a typical fleet of motor vehicles. For purpose of comparison, costs are reduced to a "per-mile" basis. These elements are four: investment charges; taxes and insurance; maintenance and operation charges for upkeep of lands, structures, garage and shop equipment; and supervision expense.

Data are given that show the relation of these elements to the total cost of operation. Cost tables of hypothetical operations illustrate Mr. Shaw's points.

On account of the effect of the annual mileage per vehicle on overhead costs, the effect on vehicles of 5000 and 50,000 miles per year is considered in each case. Although the examples taken are of light or medium-size trucks commonly used in many classes of operation, the same methods of analysis can be applied to heavier or lighter trucks, or to passenger-carrying types of vehicles.

The most important item of overhead is shown to be the vehicle investment cost.

Bus Maintenance Problems and Practices – *T. C. Howe, North Coast Transportation Co.*

THE author shows how the modern bus operator deals with his fleet, operating, and maintenance problems, and elaborates upon the developments of the various units of present-day equipment, all of which has a definite bearing on the basic problems – low cost per mile and passenger comfort.

Although low-cost maintenance can best be obtained by complete standardization of motors, other running gear, and chassis parts, with advantages in the stocking of complete replacement units, reduction in the number of replacement parts and simplification of the whole maintenance problem, he points out that this happy situation is not the lot of average operators who are faced with the problem of servicing and maintaining numerous different types and makes of units.

The objectives of the maintenance man, who is concerned with cost per bus-mile, are contrasted with those of the operating man, who is

interested in cost per seat-mile and who wants to get the greatest number of seats inside a given body with the lowest possible vehicle weight. Because of the passengers' demands for comfort and state regulations, the operating man has had to resign himself to adopting certain minimum standards of seat spacing and conform to certain maximum limits of vehicle dimension. In the author's operation the minimum seat spacing is 33 in. for short-haul buses and 36 in. for long-haul buses, and the regulations of many states fix the maximum overall length at 33 ft.

In the main part of his paper, Mr. Howe discusses the various parts that make up the modern bus and the service and maintenance problems which they individually represent. Specifically, these items are tires, brakes, rear axles, clutches, axle shafts, driveshafts, transmissions, springs, engines, bodies, as well as lubrication and mechanical inspections.

Automotive Research at the University of California – ***Prof. C. J. Vogt and Prof. F. A. Ryder, University of California.***

IN the Department of Mechanical Engineering at the University of California automotive research is classified as undergraduate research, graduate research, and faculty research.

Senior students who have shown ability are allowed to undertake special investigation of a problem of their own choosing or one suggested by the instructor.

Graduates working for advanced degrees are required to undertake a research program and carry some problem to a conclusion which is acceptable for the thesis requirements.

The work that the Department of Mechanical Engineering is doing that is important to the motor-vehicle operator may be divided into investigations in the field of internal-combustion engines and investigations in the field of illumination and safety. To indicate the type of engine work that has been in progress for the past four years the results of tests on fuels, spark plugs, crankcase oil, diesel injection systems, compressibility of oils, and cetane number are discussed. In the field of illumination and safety the work consists of statistical surveys, visibility of colored light sources, transmission and scattering of light in fog, and operator-testing work using "reactometers," coordination-testing equipment, and "glarimeters."

What the Parts Manufacturer Can Do to Reduce the Cost of Operation – ***A. T. Colwell, Thompson Products, Inc.***

THE possible means for the parts manufacturer to reduce maintenance costs fall generally into the following broad classifications:

1. Parts engineered to give the lowest operating cost per mile.
2. Availability of parts.
3. Field engineering.
4. Planning and records.
5. Complete cataloging.
6. Adequate instructions furnished with parts.
7. Technical information.
8. Standardization.

Discussing the first classification, the author points out that most manufacturers feel that, if 90% of their vehicles operate satisfactorily, the model is successful. The other 10%, however, are called upon to do exceptional work for which they were not designed, and these abused vehicles are likely to have chronic failure of one or more parts. If parts were designed for this exceptional service, 90% of the owners would be paying a premium for special parts. The obvious answer, of course, is for the 10% to use superior parts designed especially for the exceptional service. As an example, Mr. Colwell points to the Aerotype valve which, at first, was used only for the worst 10% because of its higher first cost, but is now finding wider use because it actually is reducing costs per mile.

Speaking of field engineering, Mr. Colwell urged operators to take better advantage of the knowledge and experience of the field engineers of the parts manufacturer as a powerful aid in reducing maintenance costs, giving typical examples of their helpfulness. Both operating and preventive records are discussed. Discussing cataloging, he recommends a more adequate and complete listing of parts by the parts manufacturer so that parts can be identified with the truck in which they are to be used. An example of a technical manual is given.

Depreciation – ***T. H. Mullen and R. G. Booth, Los Angeles Department of Water and Power.***

PROBABLY no single factor of transportation costs offers the field for divergence of opinion as does that of depreciation and, at the same time, no other item of cost is handled by more varied methods. Five of the more common methods in use for establishing a reserve fund for the replacement of existing equipment in a fleet are discussed: hours of actual service, mileage, fixed percentage yearly, varying percentage yearly, and fixed percentage of declining balance. The first two of these methods are based entirely on the actual usage of the equipment with the obsolescence feature ignored, and the latter three presuppose a decrease in market value regardless of the amount of usage.

A simple method is suggested wherein both the time and use factors are taken into consideration; it is felt to result in the most equitable assignment of the depreciation charge. Types of service have a decided effect on the life of equipment, and should be considered in setting up any method. This service often can be divided by utilities into two groups – major construction and ordinary system operation. Another vital element affecting the life of equipment and, parenthetically, depreciation is a policy of continuous and preventive maintenance. The subject of when to retire a unit properly is discussed at considerable length.

Section Papers

St. Louis – Jan. 25

A Study of Lubricating Problems in Rear-Mounted Engines – ***Adam Ebinger, St. Louis Public Service Co., and A. L. Heintze, Sinclair Refining Co.***

THE substance of this paper covers a 2½-yr investigation of bus-engine lubricating problems, during which time 16 distinct oil types have been given life-size service tests during approximately one million miles of operation.

There is shown the relationship of oil types to engine wear, to amount and kind of engine deposits, to drained-oil analyses, to periodic flushing, and to changes in the engine ventilating system.

A part of this paper was first given before a meeting of the St. Louis Section of the American Society of Mechanical Engineers in November, 1938, and later it was reported in considerable detail to the St. Louis Section of the Society in January, 1939.

Conclusions follow:

1. The wear of a motor is related definitely to oil type and to its refining. In bus service, at least, the solvent refined oil gives higher wear than conventionally refined oils.
2. Conventional laboratory tests for oils are no measure for expected motor wear or for the rate of sludge deposition.
3. With oils of the paraffin series, regardless of refining process, that oil which drains the cleanest leaves the most dirt in the motor, and vice versa.
4. Viscosity index gives no indication of the oil's ultimate performance; in fact, our findings rate the various oils in reverse ascending order, if viscosity index alone is considered.
5. Flushing under a fixed procedure and at regular intervals with a hot naphthenic pale oil of low viscosity will pay dividends.
6. Piston-ring and motor life can be extended 25% or more by the use of a well-designed run-in oil for at least 5 hr after the motor is assembled.
7. For a given type and kind of oil, the greater stability is had in the higher viscosities.
8. Over-refining of an oil changes the nature of the deposit left in the motor, and the more the refining the more "unhandable" the deposits become for the motor.
9. Ventilation of any motor when properly designed and applied can accomplish much in the matter of reducing engine deposits and motor wear.
10. This ventilation can be accomplished without materially affecting the oil consumption of the engine.

Tulsa Group – Feb. 3

The Application of Butane-Propane Mixtures as Fuel for Internal Combustion Engines – ***M. O. Tanberg, T. V. Supply Co.***

THAT butane is the finest fuel yet developed for internal-combustion engines and that, when used with proper precautions, it is as safe as other volatile motor fuels, is the expressed opinion of the author. In his paper is reported actual experience with butane-propane conversions for a variety of service with temperatures ranging from 17 F below zero to 180 F, and with varying atmospheric conditions as found from 250 ft below to 6000 ft above sea level. Conversions made include truck fleets, equipment of contracting firms, and public service bus fleets.

It is pointed out that, up to the present time, most of the experience with butane as fuel has been gained from the conversion of engines designed and developed to use gasoline. Therefore, in any comparisons between the diesel engine and the gasoline engine converted to butane, consideration must be given to the fact that the diesel engine is designed primarily to use one special fuel.

As referred to in this paper, butane is defined as a liquefied hydrocarbon composed principally of butane and propane; it is normally a gas and is liquefied only for ease of transportation and storage. Properties are given.

Under a heading for laboratory and field experience, testimonial statements of large users in the field are quoted. Operating variables discussed are compression ratio, combustion-chamber type, ignition system, manifold temperatures, fuel temperatures, and water-jacket temperatures. A description of the conversion equipment and general recommendations for the use of butane conclude the paper.

Chicago – Feb. 7

Factors Affecting Air-Conditioning Design for Vehicles – ***E. L. Mayo, Bishop & Babcock.***

CONSIDERING the term "air-conditioning" as defined broadly, Mr. Mayo takes up separately each of the elements which are a composite part of the results technically defined by the term as follows: controlled heating, controlled humidification, ventilation, controlled cooling, dehumidification, distribution of air, and air purification.

Only designs or devices are considered in this paper which are within the scope of reasonable commercial adaptation to passenger vehicles where many of the elements of air conditioning are still necessarily treated as accessory equipment by the manufacturers.

To provide adequate heating for temperatures as low as 10 deg below zero in the modern motor car, it is pointed out that a minimum of 10,000 Btu per hr is essential, and delivery of air should not be less than 150 to 250 cfm at suitable velocity and discharge temperature. Lack of uniformity in distributing heat equally in the car is named as the most serious defect in the performance of heating devices today.

It is stated that humidity is a most acute problem in the winter since doors and windows usually are closed and each passenger introduces ¼ lb of moisture per hr into the car. Advan-

tages of using the outside air for controlling this humidity condition are enumerated.

Discussing controlled cooling, Mr. Mayo points out that the average car operating in the northern zone requires cooling equipment with a capacity of not less than 21,000 Btu per hr to provide for leakage and infiltration losses at a speed of 60 to 65 mph, and that compressors for this service can be built weighing no more than 32 lb.

Northwest – Feb. 10

Forced Induction for Automotive Vehicles – *Prof. W. H. Paul, Oregon State College.*

PURPOSE of this paper is to discuss supercharging from the standpoint of economy and power, and the subject matter is divided into three major parts:

1. Types of superchargers, their drives, and operating characteristics.
2. Some theoretical aspects of forced induction.
3. Actual performance of engines equipped with superchargers.

Under the first heading Prof. Paul contrasts centrifugal, Roots, and vane types, as well as the various methods of mounting and driving them. Centrifugal superchargers, he says, have the advantage of being quiet and easy to silence; their construction is simple; and their cost is low. The Roots type, however, compresses a greater quantity of air at the lower speeds than does the centrifugal type, but requires considerably more power to drive it at the higher outputs. The necessity for lubricating the vanes is given as a disadvantage of the vane type, which is used mostly on European aircraft engines.

In a theoretical discussion of supercharged and unsupercharged cycles, the author concludes that "forced induction holds nothing alluring from the standpoint of increased efficiency. Let us say, rather, that it will do as *well* as the unthrottled cycle." But, from the standpoint of mean effective pressure or power output, he reports that a 48% increase is indicated for the supercharged cycle.

Interesting results are reported of the performance of separately driven superchargers. Of one truck engine equipped with a supercharger driven individually by 12-hp Austin motor, covering 30,000 miles over mountainous country, it is said that the power of the engine could be increased over 70%; the fuel economy, 12 to 15%; and the time saving is 18%, compared with the unsupercharged truck.

So. California – Feb. 15

Military Value of Commercial Aviation – *Major J. L. Stromme, Air Corps.*

POINTING to the rise and fall of nations throughout history to back his point, Major Stromme shows that those nations which failed to utilize in commerce those forces upon which they depended for defense are the nations which lost their existence and, by the same reasoning, that nation which best employs her aircraft in her everyday commerce and development will possess the greatest air force.

He shows that an important, if not decisive, advantage in the struggle to control the trade routes of the air will lie with the nation having superior aircraft.

Tracing the growth of American commercial aviation, he points out that this development is becoming a mighty adjunct to the aerial defense that is self-sustaining. Although it cannot take the place of the military air force, he explains that its existence will permit of a smaller military organization than otherwise would be necessary; that it means greater development in design and performance; a reserve of over 600 pilots trained in instrument flying; and about 1000 additional airplanes of the latest commercial types that can be used for the transportation of troops or equipment.

Commercial aviation, he concludes, is in reality a flying laboratory out of which come new developments, more efficient equipment, and more capable pilots, adding that it offers nearly 2400 air terminals to form a nucleus for repair units and air bases in an emergency.

St. Louis – Feb. 24

The Early Development of the Diesel Engine – *Leslie D. Calhoun, Busch-Sulzer Diesel Engine Co.*

TRACING the development of the diesel engine in the United States, Mr. Calhoun, in this paper, recalls how Adolphus Busch, convinced that Dr. Diesel's new engine was destined to exert an epoch-making influence in the prime mover field, "secured the entire and complete control of all Dr. Diesel's existing and future patents in the United States, its possessions, and Canada." Soon afterwards, he states, Mr. Busch organized the company which has become the Busch-Sulzer Diesel Engine Co.

The first engine to be built under these rights was completed in 1898 and, besides being the first diesel to be constructed in America, the author explains, it was the first in the world to be put into commercial service, being installed in the Anheuser-Busch Brewery.

Much of the paper is devoted to a description of slides illustrating diesel progress in the United States since 1898.